UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

UNITED STATES OF AMERICA, Plaintiff, v. CITY OF QUINCY, MASSACHUSETTS, Defendant, and, COMMONWEALTH OF MASSACHUSETTS, Nominal Party required by 33 U.S.C. § 1319(e).	CIVIL ACTION NO. 1:19-CV-10483-RGS

CONSENT DECREE

TABLE OF CONTENTS

I. STATEMENT OF CLAIM 4
II. JURISDICTION AND VENUE 4
III. APPLICABILITY 5
IV. DEFINITIONS 6
V. OBJECTIVES 11
VI. CIVIL PENALTY 13
VII. REMEDIAL MEASURES 14
VIII. REPORTS ON COMPLIANCE 40
IX. APPROVAL OF SUBMISSIONS 44
X. STIPULATED PENALTIES 45
XI. FORCE MAJEURE 48
XII. DISPUTE RESOLUTION 51
XIII. RIGHT OF ENTRY/INFORMATION COLLECTION AND RETENTION 54
XIV. FORM OF NOTICE 56
XV. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS 59
XVI. COSTS 60
XVII. EFFECTIVE DATE 61
XVIII. RETENTION OF JURISDICTION 61
XIX. MODIFICATION 61
XX. FUNDING 62
XXI. SEVERABILITY 62
XXII. TERMINATION 62
XXIII. FINAL JUDGMENT 63
XXIV. PUBLIC COMMENT 63
XXV. SIGNATORIES 63
XXVI. INTEGRATION 64
XXVII. APPENDICES 64

WHEREAS, Plaintiff, the United States of America ("United States"), on behalf of the United States Environmental Protection Agency ("EPA"), has alleged in this action that the City of Quincy, Massachusetts ("City," "Quincy," or "Defendant") has violated Section 301(a) of the Clean Water Act ("CWA" or "Act"), 33 U.S.C. § 1311(a);

WHEREAS, the United States' Complaint against the City alleges that the City violated and continued to violate Section 301 of the Act by discharging pollutants into waters of the United States from its Municipal Separate Storm Sewer System ("MS4") storm drains without authorization by the CWA's 2003 National Pollutant Discharge Elimination System ("NPDES") General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems ("2003 General Permit"), any other NPDES permit, or any other provision of the Act, and by discharging pollutants into waters of the United States as a result of Sanitary Sewer Overflows ("SSOs") from its wastewater collection system without authorization under any NPDES permit or any other provision of the CWA;

WHEREAS, EPA issued General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts on April 4, 2016, with an effective date of July 1, 2018, which was modified on December 7, 2020 with the modifications effective on January 6, 2021 (hereinafter referred to as the "Small MS4 General Permit" or "General Permit"). From April 5, 2019 to January 5, 2021, the City was subject to the terms and conditions of the original 2016 Small MS4 General Permit. From January 6, 2021 to the present the City has been subject to the terms and conditions of the 2016 Small MS4 General Permit, as modified;

WHEREAS, the City does not admit any liability to the United States arising out of the transactions or occurrences alleged in the Complaint;

WHEREAS, Section 309(e) of the Act, 33 U.S.C. § 1319(e), requires that whenever the United States brings a civil enforcement action against a municipality under Section 309, the state in which the municipality is located shall be joined as a party and the Commonwealth of Massachusetts (the "Commonwealth") was named as a nominal party in the United States' Complaint;

WHEREAS, entry of this Consent Decree by the Court will resolve all claims in the Complaint; and

WHEREAS, the settling parties, United States and the City (collectively, the "Parties"), recognize, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith and will avoid continued litigation between the Parties and that this Consent Decree is fair, reasonable, and in the public interest;

NOW, THEREFORE, with the consent of the Parties, IT IS HEREBY ADJUDGED, ORDERED, AND DECREED as follows:

I. STATEMENT OF CLAIM

1. The Complaint states claims upon which relief can be granted against the Defendant pursuant to Section 309 of the CWA, 33 U.S.C. § 1319.

II. JURISDICTION AND VENUE

2. This Court has jurisdiction over the subject matter of this action pursuant to Section 309(b) of the CWA, 33 U.S.C. § 1319(b), and 28 U.S.C. §§ 1331, 1345, and 1355. This Court has personal jurisdiction over the City. Venue properly lies in this district pursuant to

Section 309(b) of the CWA, 33 U.S.C. § 1319(b), 28 U.S.C. §§ 1391(b) and (c), and 28 U.S.C. § 1395(a). The City waives all objections it might have raised to such jurisdiction or venue.

III. APPLICABILITY

3. The provisions of this Consent Decree shall apply to and be binding upon the City and its officers, directors, agents, employees acting in their official capacities, its successors, and assigns.

4. No transfer of any ownership interest in or any interest in the operation of the City's MS4 or Collection System, whether in compliance with this Paragraph or otherwise, shall relieve the City of its obligation to ensure that the terms of this Consent Decree are implemented. Any transfer involving ownership or operation of the MS4 or Collection System, or any portion thereof, to any other person or entity must be conditioned upon the transferee's agreement to undertake the obligations required by all provisions of this Consent Decree, as provided in a written agreement between the City and the proposed transferee, enforceable by the United States as a third-party beneficiary of such agreement. At least thirty (30) Days prior to such transfer, the City shall provide a copy of this Consent Decree to the proposed transferee and shall simultaneously provide written notice of the prospective transfer, together with a copy of the above-referenced proposed written agreement, to EPA, the United States Attorney, and the United States Department of Justice in accordance with Section XIV (Form of Notice). Any noncompliance with this Paragraph constitutes a violation of this Consent Decree.

5. The City shall provide a copy of this Consent Decree to all officers, employees, and agents whose duties might reasonably include compliance with any provisions of this Consent Decree. The City shall also provide a copy of this Consent Decree to all contractors and

consultants (including engineering firms) retained to perform any obligation required by this Consent Decree on behalf of the City, and condition any such contract upon performance of the work in conformity with the terms of this Consent Decree. The City shall require that such contractors and consultants provide a copy of this Consent Decree to their subcontractors to the extent the subcontractors are performing work subject to this Consent Decree. Such contractors, consultants and subcontractors shall be deemed agents of the City for the purposes of this Consent Decree. In an action to enforce this Consent Decree, the City shall not assert as a defense against an action by EPA the failure by any of its officers, directors, employees, agents, servants, consultants, contractors, subcontractors, successors, or assigns to take actions necessary to comply with this Consent Decree.

IV. DEFINITIONS

6. Unless otherwise expressly provided herein, terms used in this Consent Decree that are defined in the CWA or in regulations promulgated under the CWA shall have the meaning ascribed to them in the CWA or in the regulations promulgated thereunder. Whenever the terms listed below are used in this Consent Decree, the following definitions shall apply.

a. "Act" or "CWA" shall mean the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act), as amended, 33 U.S.C. §§ 1251-1387.

b. "Approval by EPA" or "Approved by EPA" shall mean the issuance of a written approval document from EPA, approving, approving upon specified conditions, approving part of, or correcting a deficiency of a submission in accordance with Section IX (Approval of Submissions).

c. "Best Management Practices" or "BMPs" shall mean schedules of activities, practices and prohibition of practices, structures, vegetation, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants to waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control site and road runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

d. "Building/Private Property Backup" shall mean any release of wastewater from the City's Collection System into buildings or onto private property, except a release that is the result of blockages, flow conditions, or malfunctions of a building lateral or other piping/conveyance system that is not owned or operationally controlled by the City, or is the result of overland, surface flooding not emanating from the City's Collection System.

e. "Catchment" shall mean the geographical area served by and drained to a distinct portion of the City's MS4.

f. "Collection System" shall mean the wastewater collection, storage and transmission system (*a.k.a.* sanitary sewer system) owned or operated by the City, including, but not limited to, all devices, Sewersheds, pump stations, force mains, gravity sewer lines, manholes, and appurtenances.

g. "Commonwealth" shall mean the Commonwealth of Massachusetts.

h. "Complaint" shall mean the complaint filed by the United States in this action.

i. "Consent Decree" or "Decree" shall mean this Consent Decree and all appendices attached hereto. In the event of conflict between this Decree and any appendix, this Decree shall control.

j. "Date of Lodging" shall mean the Day this Consent Decree is filed for lodging with the Clerk of the Court for the United States District Court for the District of Massachusetts.

k. "Day" shall mean a calendar day. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, or federal or Commonwealth holiday, the period shall run until the close of business of the next business day.

l. "Effective Date" shall have the definition provided in Section XVII (Effective Date).

m. "EPA" shall mean the United States Environmental Protection Agency and any successor departments or agencies of the United States.

n. "Excessive Inflow/Infiltration" or "Excessive I/I" shall mean the Infiltration/Inflow ("I/I") that can be cost-effectively eliminated from Quincy's Collection System as determined by a cost-effectiveness analysis that compares the costs of eliminating the I/I with the total costs of transportation and treatment of the I/I (including capital costs of increasing sewage facilities capacity and treatment and the resulting operating costs).

o. "Exfiltration" shall mean the wastewater that exits the Collection System (including public sewer service connections) through such means as, but not limited to, defective pipes, pipe joints, connections or manhole structures.

p. "Flow" shall mean all wastewaters conveyed by any portion of the Collection System.

q. "Green Infrastructure/Low Impact Development" or "GI/LID" shall mean the range of stormwater control measures that use natural or engineered systems to direct stormwater to areas where it can be stored, infiltrated, evapotranspired, or reused. GI/LID may include, but is not limited to, bioretention and extended detention wetland areas, vegetated swales, pocket wetlands, rain gardens, infiltration planters, green roofs, and porous and permeable pavements.

r. "IDDE" shall mean illicit discharge, detection, and elimination.

s. "Infiltration" shall mean the water that enters the Collection System (including public sewer service connections) from the ground through such means as, but not limited to, defective pipes, pipe joints, connections or manholes. Infiltration does not include, and is distinguished from, Inflow.

t. "Inflow" shall mean all water other than sanitary flow that enters the Collection System (including public sewer service connections) from sources such as, but not limited to, roof leaders, cellar drains, yard drains, sump pumps, area drains, foundation drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, catch basins, stormwaters, surface runoff, street wash waters, or drainage. Inflow does not include, and is distinguished from, Infiltration.

u. "Infiltration/Inflow" or "I/I" shall mean the total quantity of water from both Infiltration and Inflow that enters into the Collection System without distinguishing the source.

v. "Investigation" shall mean the use of industry standard techniques to examine the Collection System and MS4 piping and infrastructure, including but not limited to television inspection, flow isolation, smoke testing, dye testing, rainfall simulation, and additionally, for the MS4, sampling and analyses and the requirements contained in Section 2.3.4.8 of the Small MS4 General Permit.

w. "MassDEP" shall mean the Massachusetts Department of Environmental Protection and any successor departments or agencies of the Commonwealth.

x. "Municipal Separate Storm Sewer System" or "MS4" shall mean a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) owned and/or operated by the City designed or used for collecting or, conveying stormwater, and discharging stormwater to receiving waters.

y. "Paragraph" shall mean a portion of this Consent Decree identified by an Arabic numeral, a lower case letter, or a lower case Roman numeral.

z. "Parties" shall mean the United States and the City of Quincy, Massachusetts.

aa. "Sanitary Sewer Overflow" or "SSO" shall mean any overflow, spill, diversion, or release of wastewater from, or caused by, the City's Collection System. SSOs include, but are not limited to, discharges to waters of the United States from the City's Collection System, as well as any release of wastewater from the City's Collection System to public or private property that does not reach waters of the United States, including wastewater backups onto public streets and Building/Private Property Backups. SSOs do not include

overflows, spills, diversions, or releases on private property from systems or components that are not owned or operated by the City, and that are not caused by the City's Collection System.

bb. "Section" shall mean a portion of this Consent Decree identified by an upper case Roman numeral.

cc. "Sewershed" shall mean a major portion of the Collection System that drains to one, or a limited number of, Major Sewer(s), with "Major Sewers" being defined as 15 inches in diameter or greater.

dd. "Small MS4 General Permit" or "General Permit" shall mean the "National Pollutant Discharge Elimination System (NPDES) General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems," issued by EPA on April 4, 2016, with an effective date of July 1, 2018, which was modified on December 7, 2020 with the modifications effective on January 6, 2021. This General Permit covers Small MS4s within the Commonwealth of Massachusetts. This General Permit applies to MS4s that are not defined as large or medium MS4s pursuant to 40 C.F.R. §§ 122.26(b)(4) and (b)(7), nor designated under 40 C.F.R. § 122.26(a)(1)(v).

ee. "United States" and "U.S." shall mean the United States of America.

V. OBJECTIVES

7. It is the express purpose of the Parties in entering into this Consent Decree to require the City to take measures necessary to fulfill the objectives of the CWA, to achieve and maintain compliance with the CWA, the Small MS4 General Permit, any NPDES permits that may be issued, or made applicable, to the City in the future, and any applicable federal and Commonwealth regulations. The City shall integrate the investigation and remediation of its

Small MS4 with the investigation and remediation of its Collection System to achieve such measures.

8. All work pursuant to this Consent Decree shall be performed using sound, generally accepted engineering practices to ensure that construction, management, operation, and maintenance of the Collection System and MS4 comply with the CWA, including consideration of practices to improve the resilience of the Collection System and MS4. Engineering designs and analyses required to be performed pursuant to this Consent Decree shall be conducted using sound engineering practices, and, as and to the extent they are applicable, consistent with: (a) EPA's "Handbook: Sewer System Infrastructure Analysis and Rehabilitation," EPA/625/6-91/030, October 1991, or as amended; (b) EPA's "Handbook for Sewer System Evaluation and Rehabilitation," EPA/430/9-75/021, December 1975; (c) "Existing Sewer Evaluation and Rehabilitation," WEF MOP FD-6, 2009, or as amended; (d) "Guide to Short Term Flow Surveys of Sewer Systems," WRc Engineering (Undated); (e) the National Association of Sewer Service Companies' "Manual of Practice"; (f) MassDEP's "Guidelines for Performing Infiltration/Inflow Analyses and Sewer System Evaluation Survey," revised January 1993, or as amended; (g) New England Interstate Water Pollution Control Commission's TR-16 "Guides for the Design of Wastewater Treatment Works," 2011, or currently effective edition; (h) EPA's "Computer Tools for Sanitary Sewer System Capacity Analysis and Planning," EPA/600/R-07/111, October 2007, or as amended; (i) EPA's Creating Resilient Water Utilities (CRWU) Initiative, available on the EPA-maintained website at https://www.epa.gov/crwu; (j) EPA's Climate Resilience Evaluation and Awareness Tool (CREAT), version 3.0, referenced at EPA 815-B-16-004, May 2016, available on the EPA-maintained website at https://www.epa.gov/crwu/build-resilience-your-

utility; and (k) the Commonwealth's Executive Order No. 569 (Establishing an Integrated Climate Change Strategy for the Commonwealth), dated September 16, 2016.

VI. CIVIL PENALTY

9. No later than thirty (30) Days after the Effective Date of this Consent Decree, the City shall pay a civil penalty in the amount of one hundred fifteen thousand dollars ($115,000) ("Civil Penalty") to the United States. Payment shall be made in accordance with the procedures set forth in Paragraph 10, below.

10. The City shall make payment to the United States by FedWire Electronic Funds Transfer ("EFT") to the United States Department of Justice in accordance with written instructions to be provided to the City, following lodging of the Consent Decree, by the United States Attorney's Office for the District of Massachusetts, Financial Litigation Unit, Boston, Massachusetts. The costs of such electronic funds transfer shall be the responsibility of the City. At the time of payment, the City shall send a copy of the EFT authorization form, the EFT transaction record, and a transmittal letter, which shall state that the payment is for the Civil Penalty owed pursuant to the Consent Decree in *United States v. City of Quincy, Massachusetts*, and shall reference the civil action number and DOJ case number 90-5-1-1-11446, to EPA and the United States Department of Justice as specified in Paragraph 65, by email to acctsreceivable.CINWD@epa.gov, and by mail to:

EPA Cincinnati Finance Office
26 Martin Luther King Drive
Cincinnati, Ohio 45268

VII. REMEDIAL MEASURES

A. Collection System

11. By October 31, 2021, the City shall submit for Approval by EPA a **Sewer System Hydraulic Model** of all Major Sewers, demonstrating the dry weather and wet weather capacity of the Major Sewer pipes, and identifying any capacity related issues or possible failure points within the Collection System, under a range of wet-weather events, including, but not limited to, the 1-, 5-, 10-, 25-, 50-, and 100-year storm event.

12. By November 30, 2022, the City shall submit for Approval by EPA a **Supplemental Sewer System Evaluation Survey ("SSES") Report** that focuses on the portions of the Collection System infrastructure that were subjects of previous evaluations and field work completed from 2011 through November 30, 2022 (SSES Areas 1 and 2). This Supplemental SSES Report shall summarize the investigations performed, the recommendations made, and whether such recommendations were implemented from 2011 through November 30, 2022 (such summary shall include a map depicting all areas investigated in this period). This Supplemental SSES Report shall contain all of the information required in Paragraph 13, below, if such information is not in the previously submitted reports. The Supplemental SSES Report shall also designate the three areas for further SSESs (SSES Areas 3, 4 and 5) in accordance with the criteria set forth in Paragraph 13, below, in order to prioritize those areas posing the greatest risk to the public and environment. If Collection System areas associated with Catchment areas tributary to Wollaston Beach, including EPA sample locations identified in the maps and sampling result spreadsheet in "EPA MS4 Outfall and Water Quality Data Collected in Quincy, MA," 2009-2020, which is attached as Appendix D, are not included in SSES Areas 1 and 2,

then such Wollaston Beach Collection System areas shall be included SSES Area 3. If Collection System areas associated with Catchment areas tributary to EPA sample location "364SeaA" in the Adams Shore area between Norton Road and Terne Road identified in the maps and sampling result spreadsheet in "EPA MS4 Outfall and Water Quality Data Collected in Quincy, MA," 2009-2020, which is attached as Appendix D, are not included in SSES Areas 1 and 2, then such "364 SeaA" Collection System areas shall be included in SSES Area 3. If Collection System areas associated with Catchment areas tributary to Sagamore Creek, including EPA sample locations identified in the maps and sampling result spreadsheet in "EPA MS4 Outfall and Water Quality Data Collected in Quincy, MA," 2009-2020, which is attached as Appendix D, are not included in SSES Areas 1 and 2, then such Sagamore Creek Collection System areas shall be included SSES Area 3.

13. The City shall submit for Approval by EPA **SSES Reports** for SSES Areas 3, 4 and 5, each of which will cover approximately one-third of the areas that have not been investigated to date, by the dates set forth below in Paragraphs 14, 15, and 16, respectively. The systematic inspection program to identify which pipes will be inspected in each SSES will consider EPA's "Asset Management: A Best Practices Guide," EPA 816-F-08-014, April 2008; the Consequence of Failure factors identified in the Consequence of Failure Analysis in Woodard & Curran's "Sanitary Sewer Risk Analysis Evaluation," June 2017, which were based on the National Association of Sewer Service Companies' ("NASSC") Pipeline Assessment and Certification Program ("PACP"); proximity of public beaches, recreational areas, drinking water supplies or shellfish beds; characteristics listed in Section 2.3.4.7.a.iii of the Small MS4 General Permit; and other real-time, variable factors including, but not limited to, recent SSOs, known I/I

problem areas, residential complaints, risks to recreational waters, other scheduled public infrastructure projects, areas of concern based on MS4 and IDDE inspections, and prior and future MS4 sampling and investigations conducted by the City and EPA based on the sampling criteria in Paragraph 29 (each SSES shall explain the consideration of these factors). Each SSES shall contain, for the areas covered by the particular SSES, the following at a minimum:

a. In addition to identifying those sources of Excessive I/I, each SSES Report shall itemize the specific measures that the City must implement to prevent each identified Collection System surcharge, SSO, or source of Exfiltration causing or contributing to water quality violations, to the extent evidenced by (i) receiving water quality sampling data (*i.e.*, seasonal beach testing results), (ii) SSOs; (iii) the Pharmaceutical and Personal Care Product ("PPCP") sampling data for MS4 discharges provided or to be provided by EPA; (iv) bacteria, ammonia, surfactants, and chlorine criteria listed in Paragraph 29, and/or (v) water quality test results conducted in accordance with the General Permit.

b. A description of the City's past investigations in the area subject to the SSES, and a listing of the recommendations and status of the City's implementation of each recommendation. If the City did not implement any specific recommendation, the City shall provide a rationale for the decision not to implement that recommendation and any necessary re-prioritization of such measures. For those prior recommendations that the City will implement in the future, the City shall include, as a separate section of the SSES Report, a schedule for implementation.

c. A tabular listing of each Sewershed that includes the following information: the acreage of each Sewershed; the linear feet of publicly-owned Collection

System sewers; the linear feet of MS4 sewers; the estimated gallons per inch-mile of I/I; the percentage of Flow within each Sewershed that is estimated to be I/I; the predominant groundwater condition throughout the year; a description of any known or suspected sources of I/I or Exfiltration; the MS4 Catchment(s) known to be or potentially affected by Exfiltration; and where feasible an estimate of the volume of Exfiltration.

d. A summary of the findings regarding the ability of each portion of the Collection System to convey current and expected Flows to the wastewater treatment facilities of the Massachusetts Water Resources Authority ("MWRA").

e. *Infiltration/Inflow - Public Sources*

i. A listing of public sources of I/I identified during the SSES;

ii. A listing of public sources of I/I that the City determined are excessive;

iii. Cost-effectiveness analyses that determine which public sources of I/I are more cost-effective to remediate than to store and/or transport and treat, and a narrative description of the bases of those analyses;

iv. Recommendations for rehabilitating each public source of Excessive I/I, and a schedule for implementing the recommendations, including engineering design and construction; and

v. Recommendations for rehabilitating or replacing each structurally-deficient portion of the Collection System identified during the SSES, to the extent not included in subparagraph iv, above, and a schedule for implementing the recommended rehabilitation/replacement measures, including engineering design and construction.

f. *Infiltration/Inflow - Private Sources*

i. A listing of private sources of I/I identified during the SSES;

ii. A listing of private sources of Excessive I/I identified during the SSES;

iii. Identification of each Sewershed that is tributary to, or contributes to, any Collection System surcharge or SSO in which Excessive I/I is determined to exist.

iv. For each identified Sewershed, each SSES Report shall include, but need not be limited to, the following information:

1. A summary of the results of building surveys conducted by the City or its agents, including an address listing of those buildings surveyed, an address listing of those buildings with identified sources of I/I, and an address listing of those buildings for which the City recommends rehabilitation of I/I sources and the recommended methods of rehabilitation;

2. A plan and schedule for surveying additional buildings that are suspected of having internal illicit connections or that are suspected of contributing to illicit discharges based upon MS4, IDDE, or SSES investigations;

3. A map that identifies: (a) the location of properties within the Sewershed; (b) each property that is an actual or potential source of material extraneous Flow to the Collection System that was identified during the SSES and/or any of the City's prior investigations; (c) each property where a private source of I/I has been identified; and (d) the extent of the City's MS4 within each Sewershed that the City has determined could be impacted by Excessive I/I; and

4. A determination of whether it is cost-effective to redirect identified private sources of Excessive I/I or to expand the Collection System to convey extraneous Flow to MWRA wastewater treatment facilities. The analysis shall include, but need not be limited to:

a. A generalized/schematic level assessment of whether conditions permit redirection of identified I/I sources to the ground and the range of homeowner costs associated with this type of remedial measure;

b. An assessment of whether the City's MS4 has sufficient capacity and can be extended to eliminate the identified I/I sources, and the range of homeowner costs associated with this type of remedial measure, including, but not limited to, the costs of redirecting extraneous Flow sources to the City's MS4;

c. An assessment of whether off-line storage within the sanitary Sewershed can be used to prevent Collection System surcharges and/or SSOs;

d. An assessment of the cost of conveying the extraneous Flow to a downstream portion of the Collection System in a manner that will not exacerbate downstream Collection System surcharges or SSOs;

e. Recommendations regarding the disposition of each identified private source of extraneous Flow;

f. The framework of a public education plan to promote the elimination of private sources of Excessive I/I, and a schedule for implementation of the plan;

g. An evaluation of whether any changes in the City's ordinances are necessary to implement or facilitate the planned remedial measures, and a proposed schedule for implementing any necessary City ordinances; and

h. A schedule to implement the private extraneous source reduction recommendations of the SSES including provisions for follow-up verification.

g. *Exfiltration*

i. The City shall include, as a separate section in each SSES Report, a discussion and listing of the portions of the Collection System from which Exfiltration to the City's MS4 may be occurring and may affect, or have the potential to affect, the City's MS4 or surface waters. This discussion and listing shall include private lateral(s) if an illicit discharge from such private lateral(s) is identified during the City's investigation of the Collection System. In making this evaluation, the City shall consider the EPA and City MS4 outfall sampling data in accordance with criteria in Paragraph 29 for the MS4 outfalls that drain the Catchments located in the area of the Collection System in question. The City shall describe the methodology for determining the scope of this list and the exclusion or inclusion of specific sewer sections, which shall be based upon the City's evaluation of information developed under the SSES regarding groundwater elevations, Collection System observations and deficiencies, and the sampling and investigations programs of the IDDE Plan pursuant to Paragraphs 29-31.

ii. The City shall describe the scope of each of its SSES investigations (*e.g.*, television inspections, dye testing, rainfall simulation) and whether the remedial measures proposed in each SSES Report are expected to remedy the Exfiltration problem.

iii. For those sections of the Collection System where, based on the weight of evidence, including but not limited to EPA sampling data, Exfiltration to the City's MS4 is causing or contributing to violations of water quality standards in surface waters within or adjacent to the City, and the remedial measures proposed in the I/I-Public Sources and I/I-Private Sources sections of each SSES Report are not expected to remedy the Exfiltration problem, the City shall propose the necessary remedial measures and a schedule for their implementation.

14. By November 30, 2025, the City shall submit for Approval by EPA **SSES Report 3** that focuses on a minimum of one third of the remaining Collection System infrastructure, including manholes and piping, not inspected by the City previously (SSES Area 3). This SSES Report shall contain all of the information required in Paragraph 13.

15. By November 30, 2028, the City shall submit for Approval by EPA **SSES Report 4** that focuses on a minimum of one half of the remaining Collection System infrastructure, including manholes and piping, not inspected by the City previously (SSES Area 4). This SSES Report shall contain all of the information required in Paragraph 13.

16. By November 30, 2031, the City shall submit for Approval by EPA **SSES Report 5** that focuses on the remaining portions of the Collection System infrastructure, including manholes and piping, not inspected by the City previously (SSES Area 5). This SSES Report shall contain all of the information required in Paragraph 13.

17. Upon Approval by EPA, the Supplemental SSES Report and each subsequent SSES Report shall be incorporated into and become enforceable under this Consent Decree, and the City shall implement the recommendations set forth in each SSES Report, as Approved by

EPA, in accordance with the schedule set forth therein and updated by subsequent approved SSES Reports. Such schedule shall not exceed three years, unless approved by EPA.

18. Beginning on October 31, 2021, and on each April 30th thereafter through April 30, 2034, the City shall submit to EPA for review, as part of the Compliance Report required to be submitted in accordance with Paragraph 35, an annual **Infrastructure Plan** for the repair of Collection System manholes and piping recommended in the prior SSES Reports, referenced in Paragraphs 12-16, as well as earlier SSES reports. Each Infrastructure Plan shall contain the following, at a minimum:

a. Text and figures setting forth the planned repairs and locations (as-built drawings do not need to be submitted to EPA but shall be provided upon request by EPA);

b. A prioritized schedule of repairs; and

c. Except for the April 30, 2034 Infrastructure Plan, for locations known to be in need of repair but may require further assessment, an explanation regarding why and how such infrastructure will be addressed in the next Infrastructure Plan, for which the City shall cause a clear and consistent accounting scheme to be employed to track the status of all applicable manholes and piping.

19. By September 30, 2021, the City shall submit for Approval by EPA a **Capacity, Management, Operation, and Maintenance ("CMOM") Program Self-Assessment** that contains the following:

a. An inventory of the Collection System that characterizes the age, condition, type of construction, and operation of each element where such information exists and provides for further collection of information where warranted;

b. An assessment of the capacity of critical elements of the Collection System; and

c. An assessment of the City's current operation and maintenance practices, all of which shall comprise the "CMOM Program Self-Assessment." The CMOM Program Self-Assessment shall be conducted in accordance with EPA's "Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary Sewer Collection Systems," EPA 305-B-05-002, January 2005 (the "Guide for Evaluating CMOM Programs") (included in this Consent Decree as Appendix A), or as amended. As part of the CMOM Program Self-Assessment, the City shall complete and submit EPA Region 1's "Wastewater Collection System CMOM Program Self-Assessment Checklist," February 2020 (the "CMOM Program Self-Assessment Checklist") (included in this Consent Decree as Appendix B), which is a Region 1 modification of the checklist included in the Guide for Evaluating CMOM Programs. The CMOM Program Self-Assessment shall include an assessment of the City's Fats, Oils, and Grease ("FOG") Program, whose purpose is to ensure that fats, oils, and grease accumulations are not impacting the Collection System capacity and contributing to SSOs. The assessment of the FOG Program shall, at a minimum, include evaluation of the following:

i. Specific requirements for the installation or upgrade of FOG control equipment at all food preparation establishments;

ii. Provisions for periodic and random FOG equipment inspections by the City;

iii. Enforcement procedures for non-compliant facilities including the ability to assess fines for violations of the program/permit/ordinance;

iv. A public education program targeted at FOG facilities;

v. Necessary modification to local regulations, including the City's sewer use ordinances, to allow full enforcement of the FOG Program including standard operating procedures for escalating enforcement from warnings through penalties;

vi. An explanation of which department(s) within the City has (have) the authority and will be responsible for (a) managing, (b) inspecting, and (c) enforcing the FOG Program; and

vii. A list of all food preparation establishments that includes average daily discharge volume.

20. Upon Approval by EPA, the CMOM Program Self-Assessment shall be incorporated into and become enforceable under this Consent Decree, and the City shall implement the actions set forth in the CMOM Program Self-Assessment, as Approved by EPA, in accordance with the schedule set forth therein.

21. By April 30, 2022, the City shall submit for Approval by EPA a **CMOM Corrective Action Plan** that shall include the following:

a. A list of any deficiencies identified by the CMOM Program Self-Assessment;

b. A list of causes and contributing factors that led to the overflows identified by the City in accordance with this Consent Decree and the CMOM Program Self-Assessment Checklist;

c. A description of the specific short and long-term actions that the City is taking, or plans to take, to address any of the deficiencies identified during the completion of the CMOM Program Self-Assessment Checklist; and

d. A schedule for implementation of the CMOM Corrective Action Plan.

22. Upon Approval by EPA, the CMOM Corrective Action Plan shall be incorporated into and become enforceable under this Consent Decree, and the City shall implement the CMOM Corrective Action Plan, as Approved by EPA, in accordance with the schedule set forth therein.

23. By April 30, 2022, the City shall consolidate all of the Collection System preventative and reactive maintenance programs and Collection System capital improvement plans into a single **CMOM Program Document**. The CMOM Program document shall be maintained at a location that is readily accessible to the City's maintenance staff, and is available for inspection by EPA and MassDEP, and review by the public, during normal business hours. The City shall maintain a digital copy of these documents on a publicly-accessible website.

24. By October 31, 2021, the City shall develop and submit for Approval by EPA an **Emergency Response Plan**. The City shall design the Emergency Response Plan as a reference guide for its employees to ensure that:

a. Should SSOs occur, the City will exercise appropriate efforts to minimize the volume of untreated wastewater discharged to the environment and the impact of the discharge to the environment and public health;

b. The City responds to and halts all SSOs as rapidly as possible;

c. Appropriate mitigation measures are employed; and

d. Appropriate measures are implemented to prevent recurrence of SSOs at the same location.

25. The Emergency Response Plan shall set forth procedures for responding to SSOs to minimize the environmental impact and potential human health risk. The Emergency Response Plan shall include, at a minimum:

a. Procedures to make the public aware of SSOs and measures to prevent public access to, and contact with, areas affected by SSOs;

b. Procedures to provide timely notice to EPA (which, at a minimum, shall meet the requirements in Paragraph 27), MassDEP, Massachusetts Division of Marine Fisheries, and local public health officials of SSOs;

c. An emergency 24-hour telephone number that can be used by the public to report SSOs;

d. A continuous review of the City's equipment to ensure availability of the equipment necessary to respond to SSOs and to implement the Emergency Response Plan;

e. Procedures to ensure the rapid dispatch of personnel and equipment to correct, to repair or to mitigate the condition causing or contributing to any SSO;

f. Procedures to ensure the preparedness, including responsiveness training, of the City's employees and contractors necessary for effective implementation of the Emergency Response Plan;

g. A system to track SSO reports and other complaints and related repairs, and to investigate the causes of any SSOs;

h. Safety training relevant to SSO response for Collection System maintenance personnel;

i. Procedures to ensure that the City will respond to and halt or contain SSOs as soon as reasonably practicable;

j. Procedures to provide information to residents experiencing Building/Private Property Backups resulting from blockages and surcharges of the Collection System regarding prevention, clean up, and disposal of wastewater pumped from buildings;

k. Procedures for investigating and documenting the causes of Building/Private Property Backups resulting from blocking or surcharges from the Collection System; and

l. A method and schedule, with respect to all SSOs: (1) to publicize on the City's website and other public locations information regarding how to report all SSOs to a single point of contact within the City; and (2) for the City, in turn, to report all SSOs to EPA, in accordance with the requirements set forth in Section VIII (Reports on Compliance).

26. Upon Approval by EPA, the Emergency Response Plan shall be incorporated into and become enforceable under this Consent Decree, and the City shall immediately and continuously implement the Emergency Response Plan, as Approved by EPA.

27. Beginning thirty (30) Days after the Date of Lodging of this Consent Decree, the City shall report all future SSOs of which it has notice, whether to surface waters or buildings or property in the City, to EPA's Water Compliance Section contact via email as set forth in Section XIV (Form of Notice). SSO events shall be tabulated in a database and located on a map of the Collection System in accordance with Paragraph 35. An initial report shall be submitted

to EPA within one (1) Day, providing all information available at the time. A written report shall be submitted to EPA within five (5) Days ("5-Day Report"). The 5-Day Report and the database shall include, but need not be limited to, the following information:

a. The date and time that the event began, if known, and was discovered by, or reported to, the City and the date the event was stopped, or if it is continuing, a schedule for its termination;

b. The location, including nearest property address, of each such event;

c. The source of notification (property owner, field crew, police, etc.);

d. The specific cause of the event, including but not limited to whether it was caused by debris, fats, oils, and grease, or root blockages; collapsed pipes; mechanical, electrical, or structural failures; hydraulic overloads; and/or vandalism;

e. The estimated gallons of wastewater released and the method used to estimate the volume;

f. A clear statement of whether or not the release entered a stormwater catch basin or any other portion of the City's MS4. If the release occurred to the ground or street, regardless of whether the discharge entered any portion of the MS4, the City shall provide the location and the distance to the nearest down gradient stormwater catch basin and the name of the receiving water to which the catch basin discharges;

g. If the release did not enter a stormwater catch basin or any other portion of the City's MS4, a clear statement of whether the release did or did not enter any surface water. If the release entered a surface water, the name of the surface water and a description of the location where the release entered the surface water;

h. The identification of any surface water that received discharge from the SSO either directly or indirectly through the MS4;

i. The estimated gallons of wastewater discharged to the MS4 or surface water, and the method used to estimate the volume;

j. The measures taken to stop the overflow and decontaminate the area affected by the overflow;

k. The measures taken to prevent future overflows at the same location; and

l. The date the overflow was reported to EPA and MassDEP.

28. The reporting requirements set forth in the preceding Paragraph do not relieve the City of its obligation to submit any other reports or information as required by Section VIII (Reports on Compliance) or by federal, Commonwealth, or local law, regulation, or permit.

B. Municipal Separate Storm Sewer System

29. The City shall inspect and sample its MS4 outfalls and MS4 discharges to other MS4s or non-City owned outfalls (including Massachusetts Department of Conservation and Recreation's MS4 and outfalls), in accordance with the requirements below. The City shall utilize the following Illicit Discharge Detection and Elimination ("IDDE") screening criteria to determine the presence of an illicit discharge, as well as the prioritization of MS4 Catchments or portions of MS4 Catchments for additional investigation. The following thresholds shall apply to stormwater samples collected by the City:

Bacteria:	Class A or B waters – *E. coli*: equal to or greater than 235 coliform forming units /100 milliliters ("cfu/100 ml") and/or *Enterococcus*: equal to or greater than 61 cfu/100 ml Class SA or SB waters – *Enterococcus*: equal to or greater than 104 cfu/100 ml

Surfactants:	equal to or greater than 0.25 milligrams per liter ("mg/l") via field kits or 0.1 mg/l via laboratory analysis
Ammonia:	equal to or greater than 0.5 mg/l via field kits or 0.1 mg/l via laboratory analysis
Chlorine:	equal to or greater than 0.02 mg/l

The following indicators, a through f, shall constitute the detection of what shall hereby be referred to as a "Potential Illicit Discharge" and shall be used to prioritize the investigation of the catchments areas associated with the outfalls and interconnections in question in this order:

a. outfalls identified by EPA, based on analytical testing, such as EPA's testing for PPCPs, including those specified in Appendix D;

b. olfactory or visual evidence of sewage;

c. an exceedance of a bacterial threshold concurrent with an exceedance of both the surfactant and ammonia thresholds;

d. an exceedance of both the surfactant and ammonia thresholds concurrent with any detectable level of chlorine;

e. an exceedance of a bacterial threshold concurrent with any detectable level of ammonia below its threshold; and

f. any detectable level of ammonia or any detectable level of surfactants (at salinity levels less than 1 part per thousand) below their respective thresholds.

An exceedance of a bacterial threshold without qualifying under a, b, c, d, e, or f, above, may indicate an illicit discharge that shall at a minimum be addressed by BMPs in accordance Paragraph 30(i), below.

30. By October 31, 2021, the City shall submit for Approval by EPA an **IDDE Plan** for screening and monitoring of all known MS4 outfalls and interconnections, investigation of all

Catchment areas, and identification and removal of illicit discharges, consistent with the schedule set forth in this Paragraph. Except as set forth in this Consent Decree, the IDDE Plan shall be consistent with EPA Region 1's "EPA New England Bacterial Source Tracking Protocol," January 2012 Draft (see Appendix C), the Small MS4 General Permit, any NPDES permits that may be issued, or made applicable, to the City in the future. The IDDE Plan shall include:

a. A preliminary MS4 Catchment area map showing the boundaries of each Catchment area and each associated MS4 outfall or interconnection;

b. A prioritization of all Catchment areas within SSES Areas 1 and 2 based on information and data available, including EPA monitoring results included in "EPA MS4 Outfall and Water Quality Data Collected in Quincy, MA," 2009-2020, which is attached as Appendix D, City monitoring results, and applicable Total Maximum Daily Loads for impaired waterbodies on the applicable EPA-approved Massachusetts CWA § 303(d) Integrated List of Waters;

c. By November 30, 2022, a prioritization of Catchment areas within SSES Areas 3, 4 and 5 based on information and data available, including EPA monitoring results included in "EPA MS4 Outfall and Water Quality Data Collected in Quincy, MA," 2009-2020, which is attached as Appendix D, City monitoring results, and applicable Total Maximum Daily Loads for impaired waterbodies on the applicable EPA-approved Massachusetts CWA § 303(d) Integrated List of Waters;

d. Dry-weather inspections: By November 30, 2021, under dry-weather conditions (less than 0.1 inches of rain in the preceding 24 hours (but 48 hours when possible)

and no significant snowmelt), the City shall inspect all MS4 outfalls and interconnections to other MS4s other than those set forth in Paragraphs 30(g)(i)(1) and (2), below, and sample those with flow. Each outfall and interconnection discharge sample shall be concurrently analyzed for all of the following parameters: *Enterococcus* bacteria or *E. coli* bacteria, as appropriate, surfactants, ammonia, total residual chlorine, temperature, conductivity, and salinity using laboratory analysis or instrumentation defined in Tables 1 and 2 of EPA Region 1's "EPA New England Bacterial Source Tracking Protocol," January 2012 Draft (included in this Consent Decree as Appendix C). The City shall maintain detailed and accurate records of the date and time that sampling was conducted and the weather conditions both during, and in the 48 hours prior to, each sampling event. The City shall repeat these dry-weather inspections by November 30, 2022.

e. Wet-weather inspections: By November 30, 2022, at least once during wet weather conditions, the City shall inspect and sample all MS4 outfalls and interconnections to other MS4s other than those set forth in Paragraphs 30(g)(i)(1) and (2), below. For the purposes of sampling outfalls or interconnections, "wet-weather conditions" should consist of at least 0.25-inches of rain over the 24 hour period prior to sampling. To facilitate sample planning and execution, however, precipitation events sufficient to produce any flow in outfalls or interconnections to be sampled will also be acceptable. Each outfall or interconnection discharge samples shall be concurrently analyzed for all of the following parameters: *Enterococcus* bacteria or *E. coli* bacteria, as appropriate, surfactants, ammonia, total residual chlorine, temperature, conductivity, and salinity using laboratory analysis or instrumentation defined in Tables 1 and 2 of EPA Region 1's "EPA New England Bacterial Source Tracking Protocol,"

January 2012 Draft (see Appendix C). The City shall maintain detailed and accurate records of the date and time that sampling was conducted and the weather conditions both during, and in the 24 hours prior to, each sampling event.

f. Outfall monitoring program: By April 30, 2023, the City shall submit for Approval by EPA a proposal for future dry- and wet-weather inspections ("Outfall Monitoring Program"). Upon Approval by EPA, the Outfall Monitoring Program shall be incorporated into and become enforceable under this Consent Decree, and the City shall implement the Outfall Monitoring Program, as Approved by EPA, in accordance with schedule set forth therein.

g. A schedule for completion of Catchment area investigations, which shall provide as follows:

i. MS4 Catchment Areas Associated with SSES Areas 1 and 2:

1. By October 31, 2021, the City shall complete investigations of the MS4 Catchment areas tributary to Wollaston Beach, including EPA sample locations identified in the maps and sampling result spreadsheet in "EPA MS4 Outfall and Water Quality Data Collected in Quincy, MA," 2009-2020, which is attached as Appendix D.

2. By October 31, 2021, the City shall complete investigations of the MS4 Catchment area tributary to EPA sample location "364SeaA" in the Adams Shore area between Norton Road and Terne Road identified in the maps and sampling result spreadsheet in "EPA MS4 Outfall and Water Quality Data Collected in Quincy, MA," 2009-2020, which is attached as Appendix D.

3. By November 30, 2022, the City shall complete investigations of the remaining MS4 Catchment areas associated with SSES Areas 1 and 2.

ii. By November 30, 2025, the City shall complete investigations of the MS4 Catchment areas associated with SSES Area 3.

iii. By November 30, 2028, the City shall complete investigations of the MS4 Catchment areas associated with SSES Area 4.

iv. By November 30, 2031, the City shall complete investigations of the MS4 Catchment areas associated with SSES Area 5.

h. Illicit discharge removal and abatement: This program shall contain the following schedule for removal of illicit discharges and confirmation of elimination:

i. Upon detection of a Potential Illicit Discharge, the City shall locate, identify and eliminate the illicit discharge as expeditiously as possible. Upon identification of the illicit source, the City shall notify all responsible parties for any such discharge and require immediate cessation of improper disposal practices in accordance with its legal authorities. Where elimination of a direct-plumbed source(s) of an illicit discharge within sixty (60) Days of its identification as the source is not possible, the City shall establish an expeditious schedule, not to exceed one (1) year, for its elimination and report the dates of identification and schedules for removal in the City's Compliance Report. Where elimination of other identified source(s) (including indirect sources(s)) of an illicit discharge within sixty (60) Days of its identification as the source is not possible, the City shall establish an expeditious schedule, not to exceed three (3) years, for its elimination and report the dates of identification and schedules for removal in the City's Compliance Report. The City shall immediately commence actions necessary for elimination. The City shall diligently pursue elimination of all illicit discharges. In the interim, the City shall take all reasonable and prudent measures to

minimize the discharge of pollutants to and from its MS4. Upon detection of a Potential Illicit Discharge at an MS4 outfall located on a bathing beach, the City shall post a notice at the outfall stating "No Swimming Near Outfall—Contaminated Stormwater" until outfall sampling and resulting analytical data have confirmed elimination of the illicit discharge. The period between identification and elimination of an illicit discharge is not a grace period. Discharges from the MS4 that are mixed with an illicit discharge are not authorized and remain unlawful until eliminated.

ii. Within one (1) year following the removal of a verified illicit discharge, the City shall conduct additional dry- and wet-weather monitoring to confirm that the illicit discharge has been eliminated. Sampling required pursuant to Paragraphs 30(d), (e) and (f), above, if conducted within one (1) year of the removal of a verified illicit discharge, shall satisfy this Paragraph's confirmatory sampling requirement. If confirmatory screening indicates evidence of a continued Potential Illicit Discharge, the Catchment shall be scheduled for additional investigation and illicit discharge removal under Paragraph 30(h)(i). In the event EPA informs the City that illicit discharges have not been eliminated from a particular outfall, based upon City data or EPA data (including EPA's PPCP data), the Catchment shall be scheduled for additional investigation and illicit discharge removal.

i. BMPs: The City shall include BMPs to eliminate sources of pollutants. Where the City's IDDE investigation identifies a source of pollutants to the City's MS4 whose elimination requires implementation of BMPs, the City shall include recommendations for implementing applicable GI/LID BMPs to address the MS4 pollutant discharge. Where GI/LID BMPs are not recommended for implementation, the City shall provide a reason why such

GI/LID BMP implementation is not being recommended for each particular location, and shall include such explanation in the particular Compliance Report required to be submitted in accordance with Section VIII (Reports on Compliance).

31. Upon Approval by EPA, the IDDE Plan shall be incorporated into and become enforceable under this Consent Decree, and the City shall implement the IDDE Plan, as Approved by EPA, in accordance with the schedule set forth therein. In no event shall the schedule for investigations of all Catchment areas discharging from the City's system conducted according to the City's priority ranking order and removal of all identified illicit discharges extend beyond December 31, 2034, unless this date is changed by modification of the Consent Decree pursuant to Paragraph 77.

C. Revised Plans Following Issuance of Any Future NPDES Permits

32. Within one hundred eighty (180) Days after any NPDES permit that may be issued, or made applicable, to the City in the future is made effective, the City shall submit for Approval by EPA plans for the design, construction, operation, and maintenance of any additional remedial measures that would be required in order for the City to comply with such future NPDES permit and the Act in the form of, if and as necessary, a Revised SSES Report, a Revised CMOM Corrective Action Plan, a Revised Emergency Response Plan, a Revised IDDE Plan, and any additional plans for the Collection System and MS4. If a Revised SSES Report, a Revised CMOM Corrective Action Plan, a Revised Emergency Response Plan, a Revised IDDE Plan, and any additional plans for the Collection System and MS4 are not necessary, the City shall submit for Approval by EPA a letter explaining why such revised report or plan(s) or any additional plans for the Collection System and MS4 are not necessary. Any revised report or

plan(s) shall include and emphasize the use of all appropriate currently available GI/LID techniques. Where GI/LID BMPs are not recommended for implementation, the City shall provide a reason why such BMP implementation is not being recommended for each particular location. Any revised report or plan(s) shall include a schedule that shall provide for the required remedial measures to be performed as expeditiously as possible. Upon Approval by EPA, these revised report or plan(s) or any additional plans for the Collection System and MS4 shall be incorporated into and become enforceable under this Consent Decree, and the City shall implement these revised report or plan(s) or any additional plans for the Collection System and MS4, as Approved by EPA, in accordance with the schedule(s) set forth therein.

D. Geographic Information System Maps

33. By October 31, 2021, the City shall develop and submit for Approval by EPA a **Geographic Information System ("GIS") or other digital map** of the City's Collection System and MS4 to facilitate the City's operation and maintenance of its Collection System and MS4. Thereafter, on each October 31st and April 30th through termination of this Consent Decree, the City shall submit to EPA for review **updated maps** reflecting newly developed and/or discovered information, corrections, and modifications in conjunction with the Compliance Reports submitted pursuant to Section VIII (Reports on Compliance) of this Consent Decree. Such mapping shall be designed to provide a comprehensive depiction of key infrastructure and factors influencing the proper operation and maintenance of the City's Collection System and MS4, and each update shall include progress toward achieving that design. Mapping themes shall include: water resource and topographic features; sanitary and stormwater sewer infrastructure; prior investigation and study findings; cleaning and repair

activities; and capital projects. The scale and detail of the maps shall be appropriate to facilitate a clear understanding of the City's Collection System and MS4 by the City, EPA, and MassDEP. In addition, the mapping shall serve as a planning tool for the implementation of future remedial measures, shall delineate the extent of completed and planned investigations and corrections, and other related capital projects. To ensure legible mapping, information shall be grouped appropriately and represented thematically (*e.g.*, by color coding) with legends or schedules where possible. Mapping shall be updated as necessary to reflect newly developed and discovered information, corrections, or modifications. The following information and features shall, at a minimum, be available to be included in the mapping:

a. Base Map

i. Municipal boundaries;

ii. Street names;

iii. Private property delineations; and

b. Water Resources and Topographic Features

i. Water bodies and watercourses identified by name and all use impairments identified in Massachusetts' most recent Integrated List of Waters prepared to fulfill reporting requirements of Section 303(d) of the Clean Water Act; and

ii. Topography;

c. Infrastructure (color-coded by owner)

i. MS4:

1. Outfalls;

2. Pipes (including size and material);

3. Open channel conveyances (*e.g.*, swales, ditches);

4. Catch basins;

5. Manholes;

6. Interconnections;

7. Municipally-owned stormwater treatment structures (*e.g.*, detention and retention basins, infiltration systems, bioretention areas, water quality swales, gross particle separators, oil/water separators, or other proprietary systems); and

8. Delineation of Catchment areas for each outfall;

ii. Collection System:

1. Pipes (including size, material, and approximate age);

2. Flow type (*e.g.*, pressure, vacuum, gravity);

3. Manholes;

4. Pump stations (public and private), and other key sewer appurtenances);

5. Locations of interceptor sewers; and

6. Delineation of Sewershed areas for each connection to the interceptor sewer;

iii. Sewersheds or sewer alignments experiencing inadequate level of service (with indication of reason(s));

iv. Common/twin-invert manholes or structures (*i.e.*, structures serving or housing both separate storm and sanitary sewers);

v. Collection System alignments served by known or suspected underdrain systems; and

vi. Sewer alignments with common trench construction and major crossings representing high potential for communication during high groundwater conditions; and

d. Investigations, remediation, and capital projects completed for the City's MS4 and Collection System in accordance with this Consent Decree, including:

i. Alignments, dates, and thematic representation of work completed (with legend) of past investigations (*e.g.*, flow isolation, dye testing, closed-circuit television, etc.);

ii. Locations of suspected, confirmed, and eliminated illicit discharges (with dates and flow estimates) to the City's MS4;

iii. Alignments and dates of past and planned infrastructure remediation projects;

iv. Planned Collection System and MS4 capital projects; and

v. Proposed phasing of future capital projects.

E. Schedule

34. All remedial measures required to be performed by the City under this Section shall be completed by December 31, 2034.

VIII. REPORTS ON COMPLIANCE

35. Beginning on October 31, 2021, and on each April 30th and October 31st thereafter through termination of this Consent Decree, the City shall submit to EPA for review

Compliance Reports for the previous six-month period (the previous April 1st through September 30th for the October report, and October 1st through March 31st for the April report) (each, a "Reporting Period"). Each Compliance Report shall include, at a minimum, the following items:

a. A listing of all illicit discharges identified during the previous Reporting Period, including the following:

i. The estimated flow from each illicit discharge;

ii. The actions taken by the City to remove each illicit discharge;

iii. The date each illicit discharge was identified and removed; and

iv. The resulting estimated volume removed from the City's MS4 under the IDDE Plan during the Reporting Period for each individual illicit discharge, cumulative for the Reporting Period, and cumulative for all illicit discharges to date; and

v. An appendix that contains a summary listing of the address, associated volume of sewage and/or industrial/commercial wastewater, and date of elimination for all illicit discharges cumulative to date.

b. An appendix that contains a listing of each Catchment area, the percentage within each Catchment area investigated during the Reporting Period, and the cumulative percentage of IDDE investigations completed for each Catchment area.

c. A chronological list of each of the following categories of SSO events that occurred during the Reporting Period: all releases that have reached surface waters or that demonstrate a reasonable potential to reach surface waters such as releases to streets or areas with storm drain catch basins; Building/Private Property Backups; and citizen reports of SSO

events, including Building/Private Property Backups. Each of the lists shall include, but need not be limited to, the following information:

i. The date and time(s) when each event was discovered/reported and was stopped;

ii. The location by address;

iii. The final disposition of the SSO, *e.g.*, whether it discharged to the ground, street, or surface water, including: the name of the water body, street, or intersecting streets nearest the SSO; and, if the release occurred to the ground or street, the name of the nearest downgradient MS4 catch basin and the name of the receiving water of the MS4;

iv. The source of notification (*e.g.*, property owner, general public, field crew, police);

v. The cause(s) of the event (*e.g.*, vandalism, sediments, roots, grease, mechanical, electrical and structural failures, capacity issues);

vi. A determination of whether the event was caused by blockages or hydraulic limitations within the publicly-owned portion of the Collection System;

vii. The measures taken to stop the event;

viii. The estimated gallons of wastewater released, the estimated gallons of wastewater that reached a surface water, and the bases for those estimates; and

ix. The date of the last SSO that occurred at the event location.

d. A GIS map or figure, consistent with the requirements of Paragraph 33, which shall include indicating the location of each illicit discharge and SSO event (including a Building/Private Property Backup);

e. A description of the activities undertaken during the Reporting Period to address the CMOM Program Self-Assessment and CMOM Corrective Action Plan;

f. A description of any additional activities undertaken during the Reporting Period directed at achieving compliance with this Consent Decree;

g. A description of any proposed changes to the remedial measures;

h. An identification of all plans, reports, and other submissions required by this Consent Decree that the City completed and submitted during the Reporting Period;

i. A description of the activities the City plans to undertake during the six months following the Reporting Period in order to achieve compliance with this Consent Decree; and

j. An identification of any material noncompliance with the requirements of this Consent Decree. If any noncompliance is reported, the notification shall include the following information:

i. A description of the noncompliance;

ii. A description of any actions taken or proposed by the City to comply with any lapsed requirements;

iii. A description of any factors that tend to explain or mitigate the noncompliance; and

iv. The date by which the City will perform the required action.

36. The reporting requirements set forth in this Section do not relieve the City of its obligation to submit any other reports or information as required by federal, Commonwealth or local law or regulation.

IX. APPROVAL OF SUBMISSIONS

37. After review of any plan, report, or other item that is required to be submitted for Approval by EPA pursuant to this Consent Decree, EPA shall in writing: a) approve the submission; b) approve the submission upon specified conditions; c) approve part of the submission and disapprove the remainder; or d) disapprove the submission.

38. If the submission is approved pursuant to Paragraph 37(a), the City shall take all actions required by the plan, report, or other document, in accordance with the schedules and requirements of the plan, report, or other document, as approved. If the submission is conditionally approved or approved only in part, pursuant to Paragraph 37(b) or (c), the City shall, upon written direction from EPA, take all actions required by the approved plan, report, or other item that EPA determines are technically severable from any disapproved portions, subject to the City's right to dispute only the specified conditions or the disapproved portions, under Section XII (Dispute Resolution).

39. If the submission is disapproved in whole or in part pursuant to Paragraph 37(c) or (d), the City shall, within thirty (30) Days or such other time as the Parties agree to in writing, correct all deficiencies identified in writing by EPA and resubmit the plan, report, or other item, or disapproved portion thereof, for approval, in accordance with the preceding Paragraphs. If the resubmission is approved in whole or in part, the City shall proceed in accordance with the preceding Paragraph.

40. If a resubmitted plan, report, or other item, or portion thereof, is disapproved in whole or in part, EPA may again require the City to correct any deficiencies, in accordance with

the preceding Paragraphs, or may itself correct any deficiencies, subject to the City's right to invoke Dispute Resolution and the right of EPA to seek stipulated penalties.

41. Any stipulated penalties applicable to the original submission, as provided in Section X of this Decree, shall accrue during the 30-Day period or other specified period, but shall not be payable unless the resubmission is untimely or is disapproved in whole or in part, provided that, if the original submission was so deficient as to constitute a material breach of the City's obligations under this Decree, the stipulated penalties applicable to the original submission shall be due and payable notwithstanding any subsequent resubmission.

X. STIPULATED PENALTIES

42. The City shall pay stipulated penalties to the United States for violations or noncompliance with the requirements of this Consent Decree, as set forth below, unless excused under Section XI (Force Majeure). A violation or noncompliance includes failing to perform an obligation required by the terms of this Consent Decree, including any work plan or schedule approved under this Decree, according to all applicable requirements of this Consent Decree and within the specified time schedules or by the date(s) established by or approved under this Decree.

a. Late Payment of Civil Penalty. If the City fails to pay the Civil Penalty required to be paid under Section VI (Civil Penalty) when due, the City shall pay a stipulated penalty as follows:

Penalty Per Violation Per Day	Period of Noncompliance
$ 750	1st through 10th Day
$ 1,500	11th through 20th Day
$ 2,500	21st Day and beyond.

b. Reporting Requirements. For every Day that the City fails timely to submit a report required by Paragraph 35 of this Consent Decree or fails to provide the certification required by Paragraph 66, the City shall pay a stipulated penalty as follows:

Penalty Per Violation Per Day	Period of Noncompliance
$ 750	1st through 10th Day
$ 1,500	11th through 20th Day
$ 2,500	21st Day and beyond.

c. SSOs. For each Day that an SSO occurs, the City shall pay a stipulated penalty of $6,500. Notwithstanding the foregoing, the City shall not be liable for such a stipulated penalty if all of the following conditions are met: (i) the City stopped the SSO as soon as reasonably practicable; (ii) the City is in full compliance with all other schedules and requirements set forth pursuant to Section VII (Remedial Measures) of this Consent Decree; and (iii) the City has complied with all reporting requirements related to SSO discharges set forth in this Consent Decree.

d. Remedial Measures. For every Day that the City fails to timely meet the requirements of Section VII (Remedial Measures) of this Consent Decree, including but not limited to, submitting an approvable plan, schedule, report, or other item, other than a report required by Paragraph 35, or fails to implement remedial requirements in a plan, schedule, report, or other item Approved by EPA, the City shall pay a stipulated penalty as follows:

Penalty Per Violation Per Day	Period of Noncompliance
$ 750	1st through 10th Day
$ 1,000	11th through 20th Day
$ 2,500	21st Day and beyond.

43. Stipulated penalties shall automatically begin to accrue on the Day after performance is due or on the Day a violation occurs and shall continue to accrue each Day until performance is satisfactorily completed or until the violation or noncompliance ceases. Stipulated penalties shall accrue simultaneously for separate violations of or instances of noncompliance with this Consent Decree.

44. Unless it has elected to pursue dispute resolution detailed in Section XII (Dispute Resolution), below, the City shall pay stipulated penalties as specified in this Section by delivering the payments to the United States within thirty (30) Days of the date of the United States' written demand for payment of stipulated penalties in accordance with the instructions set forth below:

a. The City shall pay stipulated penalties to the United States in the manner set forth and with the confirmation notices required by Paragraph 10, except that the transmittal letter shall state that the payment is for stipulated penalties and shall state for which violation(s) or noncompliance the penalties are being paid.

b. In the event the City fails to pay stipulated penalties according to the terms of this Consent Decree, such penalty (or portion thereof) shall be subject to interest at the statutory judgment rate set forth at 28 U.S.C. § 1961, accruing as of the date payment became due. Nothing in this Paragraph shall be construed to limit the United States from seeking any remedy otherwise provided by law for failure of the City to pay any stipulated penalties.

45. Stipulated penalties shall continue to accrue as provided in Paragraph 43, during any dispute resolution, but need not be paid unless and until the following:

a. If the dispute is resolved by agreement or a decision of EPA that is not appealed to the Court, the City shall pay accrued penalties determined to be owed, together with interest, to the United States within thirty (30) Days of the Effective Date of the agreement or the receipt of EPA's decision or order.

b. If the dispute is appealed to the Court and the United States prevails in whole or in part, the City shall pay all accrued penalties determined to be owed, together with interest, within sixty (60) Days of receiving the Court's decision or order, except as provided in subparagraph c, below.

c. If any Party appeals the District Court's decision, the City shall pay all accrued penalties determined to be owed, together with interest, within fifteen (15) Days of receiving the final appellate court decision if that decision confirms that a penalty is due.

46. Stipulated penalties are not the United States' exclusive remedy for violations of this Consent Decree. Subject to the provisions of Section XV (Effect of Settlement/Reservation of Rights), the United States expressly reserves the right to seek any other relief it deems appropriate for the City's violation of this Consent Decree or applicable law, including but not limited to an action against the City for statutory penalties, additional injunctive relief, mitigation or offset measures, and/or contempt. The amount of any statutory penalty assessed for a violation of this Consent Decree shall be reduced by the amount of any stipulated penalty assessed and paid pursuant to this Consent Decree.

XI. FORCE MAJEURE

47. "Force Majeure," for purposes of this Consent Decree, is defined as any event arising from causes beyond the control of the City or of any entity controlled by the City,

including its consultants, contractors and subcontractors, that delays or prevents the timely performance of any obligation under this Consent Decree notwithstanding the City's best efforts to fulfill the obligation. The requirement that the City exercise "best efforts" includes using best efforts to anticipate any potential Force Majeure event and best efforts to address the effects of any such event (a) as it is occurring and (b) after it has occurred to prevent or minimize any resulting delay to the greatest extent possible. "Force Majeure" does not include the City's financial inability to perform any obligation under this Consent Decree. Stipulated Penalties shall not be due for the number of Days of noncompliance caused by a Force Majeure event as defined in this Section, provided that the City complies with the terms of this Section.

48. If any event occurs which may delay or prevent the performance of any obligation under this Consent Decree, whether or not caused by a Force Majeure event, the City shall notify EPA within seventy-two (72) hours after the City first knew or should have known that the event might cause a delay. Within five (5) working Days thereafter, the City shall submit for Approval by EPA, at the addresses specified in Section XIV (Form of Notice), a written explanation of the cause(s) of any actual or expected delay or noncompliance, the anticipated duration of any delay, the measure(s) taken and to be taken by the City to prevent or minimize the delay, a proposed schedule for the implementation of such measures, and a statement as to whether, in the opinion of the City, such event may cause or contribute to an endangerment to public health, welfare, or the environment. Notwithstanding the foregoing, the City shall notify EPA orally within twenty-four (24) hours of becoming aware of any event that presents an imminent threat to the public health or welfare or the environment and provide written notice to EPA within seventy-two (72) hours of discovery of such event. The City shall be deemed to know of any circumstances of

which the City or any entity controlled by the City, including its consultants, contractors, and subcontractors, knew or should have known. Failure to provide timely and complete notice in accordance with this Paragraph shall constitute a waiver of any claim of Force Majeure with respect to the event in question.

49. If EPA agrees that a delay or anticipated delay is attributable to Force Majeure, the time for performance of the obligations under this Consent Decree that are affected by the Force Majeure event shall be extended by EPA for a period of time as may be necessary to allow performance of such obligations. EPA will notify the City in writing of the length of the extension, if any, for performance of the obligations affected by the Force Majeure event.

50. If EPA does not agree the delay or anticipated delay is attributable to Force Majeure, or on the number of Days of noncompliance caused by such event, EPA will notify the City in writing of its decision. The City may then elect to initiate the dispute resolution process set forth in Section XII (Dispute Resolution). In any dispute resolution proceeding in which the City asserts Force Majeure, the City shall have the burden of demonstrating by a preponderance of the evidence that the delay or anticipated delay has been or will be caused by a Force Majeure event, that the duration of the delay or the extension sought was or will be warranted under the circumstances, and that "best efforts" were exercised to avoid and mitigate the effects of the delay, and that the City complied with the requirements of Paragraphs 47 and 48, above. If the City carries this burden, the delay at issue shall be deemed not to be a violation by the City of the affected obligation(s) of this Consent Decree identified to EPA and the Court.

51. Delay in performance of any obligation under this Consent Decree shall not automatically justify or excuse delay in complying with any subsequent obligation or requirement of this Decree.

52. Failure of the City to obtain any Commonwealth or federal grants or loans shall not be considered a Force Majeure event under this Consent Decree.

XII. DISPUTE RESOLUTION

53. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures set forth in this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree. The City's failure to seek resolution of a dispute under this Section shall preclude the City from raising any such undisputed issue as a defense to an action by the United States to enforce any obligation of the City arising under this Decree. The procedures set forth in this Section shall not apply to actions by the United States to enforce obligations that the City has not disputed in accordance with this Section.

54. Informal Dispute Resolution. Any dispute subject to dispute resolution under this Consent Decree shall first be the subject of informal negotiations. The dispute shall be considered to have arisen when the City sends the United States a written Notice of Dispute. Such Notice of Dispute shall state clearly the matter in dispute, and shall be sent within twenty one (21) Days after receipt of a notice of disapproval, correction of deficiencies, or approval upon specified conditions, a Force Majeure determination by EPA, or a written demand for payment of stipulated penalties. If the City fails to give such notice, it shall be deemed to have waived any right to invoke dispute resolution regarding such dispute, and the position advanced

by the United States shall be considered binding. The period of informal negotiations shall not exceed thirty (30) Days from the date the dispute arises, unless that period is modified by written agreement between the Parties. If the Parties cannot resolve a dispute by informal negotiations, then the position advanced by the United States shall be considered binding unless, within twenty (20) Days after the conclusion of the informal negotiation period, the City invokes formal dispute resolution procedures as set forth below.

55. Formal Dispute Resolution. The City shall invoke formal dispute resolution procedures, within the time period provided in the preceding Paragraph, by serving on the United States a written Statement of Position regarding the matter in dispute. The City's Statement of Position shall include, but need not be limited to, any factual data, analysis, or opinion supporting the City's position and any supporting documentation relied upon by the City.

56. The United States shall serve its Statement of Position within forty-five (45) Days of receipt of the City's Statement of Position. The United States' Statement of Position shall include, but need not be limited to, any factual data, analysis, or opinion supporting that position and any supporting documentation relied upon by the United States. The Director of the Enforcement and Compliance Assurance Division, EPA Region 1, will issue a decision resolving the matter in dispute. The decision of the Director of the Enforcement and Compliance Assurance Division shall be binding on the City, subject only to the right to seek judicial review, in accordance with the following Paragraph. EPA shall maintain a record of the dispute, which shall contain all statements of the Parties, including supporting documentation, submitted pursuant to this Section, and the decision of the Director of the Enforcement and Compliance Assurance Division.

57. The City may seek judicial review of the dispute by filing with the Court and serving on the United States, in accordance with Section XIV (Form of Notice), a motion requesting judicial resolution of the dispute. The motion must be filed within ten (10) Days of receipt of EPA's decision pursuant to the preceding Paragraph. The motion shall contain a written statement of the City's position on the matter in dispute, including any supporting factual data, analysis, opinion, or documentation, and shall set forth the relief requested and any schedule within which the dispute must be resolved for orderly implementation of the Consent Decree.

58. The United States shall respond to the City's motion within the time period allowed by the Federal Rules of Civil Procedure and the Local Rules of this Court. The City may file a reply memorandum, to the extent permitted by the Federal Rules of Civil Procedure and the Local Rules.

59. Standard of Review.

a. Except as otherwise provided in this Consent Decree, in any dispute governed by Paragraphs 55 to 58, the City shall bear the burden of demonstrating that its position complies with this Consent Decree and that it is entitled to relief under applicable principles of law.

b. In any dispute brought before this Court, the Parties reserve the right to argue what the appropriate standard of review should be under applicable principles of law. The United States reserves the right to argue that its position is reviewable only on the administrative record and must be upheld unless arbitrary and capricious or otherwise not in accordance with law.

60. The invocation of dispute resolution procedures under this Section shall not, by itself, extend, postpone, or affect in any way any obligation of the City under this Consent Decree, unless and until final resolution of the dispute so provides. Stipulated penalties with respect to the disputed matter shall continue to accrue from the first Day of noncompliance, but payment shall be stayed pending resolution of the dispute as provided in Paragraph 45. If the City does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section X (Stipulated Penalties).

XIII. RIGHT OF ENTRY/INFORMATION COLLECTION AND RETENTION

61. EPA and its contractors, consultants, and attorneys shall have authority to enter any property and/or facility owned and/or controlled by the City, at all reasonable times, upon proper identification, for the purposes of: (a) monitoring the progress of activity required by this Consent Decree; (b) verifying any data or information submitted to EPA under this Consent Decree; (c) assessing the City's compliance with this Consent Decree; (d) obtaining samples and, upon request, splits of any samples taken by the City or its representatives, contractors, or consultants; and (e) obtaining documentary evidence, including photographs and similar data. Upon request, EPA shall provide the City splits of any samples taken by EPA. This requirement is in addition to, and does not limit, the authority of EPA pursuant to the CWA or any other provision of federal law or regulation.

62. Until five (5) years after the termination of this Consent Decree, the City shall retain all non-identical copies of all documents, records, or other information (including documents, records, or other information in electronic form) generated by the City, and all data collected and all reports generated by the City's agents (including data and reports in electronic

form), that relate in any manner to the City's performance of its obligations under this Consent Decree. This information retention requirement shall apply regardless of any contrary corporate or institutional policies or procedures. At any time during this information-retention period, upon request by the United States, the City shall provide copies of any documents, records, or other information required to be maintained under this Paragraph.

63. At the conclusion of the information-retention period provided in the preceding Paragraph, the City shall notify the United States at least ninety (90) Days prior to the destruction of any documents, records, or other information subject to the requirements of the preceding Paragraph and, upon request by the United States, the City shall deliver any such documents, records, or other information to EPA. The City may assert that certain documents, records, or other information is privileged under the attorney-client privilege or any other privilege recognized by federal law. If the City asserts such a privilege, it shall provide the following: (1) the title of the document, record, or information; (2) the date of the document, record, or information; (3) the name and title of each author of the document, record, or information; (4) the name and title of each addressee and recipient; (5) a description of the subject of the document, record, or information; and (6) the privilege asserted by the City. However, no documents, records, data, reports or other information created or generated pursuant to the requirements of this Consent Decree shall be withheld on grounds of privilege.

64. This Consent Decree in no way limits or affects any right of entry and inspection, or any right to obtain information, held by the United States pursuant to applicable federal laws, regulations, or permits, nor does it limit or affect any duty or obligation of the City to maintain

documents, records, or other information imposed by applicable federal laws, regulations, or permits.

XIV. FORM OF NOTICE

65. Unless otherwise specified herein, whenever notifications, submissions, or communications are required by this Consent Decree, they shall be made in writing to the following respective addresses. Any Party may, by written notice to the other Parties, change its designated notice recipient, address, or means of notice (including the substitution of electronic notice via email instead of notice via mail). Notices submitted pursuant to this Section shall be deemed submitted upon mailing, unless otherwise provided in this Consent Decree or by written agreement of the Parties.

As to the U.S. Department of Justice

Chief, Environmental Enforcement Section
Environment & Natural Resources Division
United States Department of Justice
P.O. Box 7611 - Ben Franklin Station
Washington, DC 20044
DJ # 90-5-1-1-11446

As to the United States Attorney

Susan M. Poswistilo
Assistant U.S. Attorney
John Joseph Moakley Courthouse
One Courthouse Way, Ste. 9200
Boston, Massachusetts 02210
Susan.Poswistilo@usdoj.gov

As to EPA

Todd Borci
Enforcement Officer
Water Compliance Section

Enforcement and Compliance Assurance Division
U.S. Environmental Protection Agency, Region 1
5 Post Office Square – Suite 100
Mail Code 04-4
Boston, MA 02109-3912
borci.todd@epa.gov

Man Chak Ng
Senior Enforcement Counsel
Office of Regional Counsel
U.S. Environmental Protection Agency, Region 1
5 Post Office Square – Suite 100
Mail Code 04-2
Boston, MA 02109-3912
ng.manchak@epa.gov

The City shall provide all submissions and notices required to be submitted to EPA (including report appendices) via electronic mail no later than the due date(s) specified in this Consent Decree, in addition to providing a hard copy in accordance with the terms of this Paragraph. The City shall provide complete copies to EPA's designated Water Compliance Section contact and EPA counsel, as specified above, of all other submissions and notices required to be made by the City to EPA pursuant to this Decree; except that with respect to copies of reports, schedules, plans, and other items required to be submitted to EPA counsel pursuant to Sections VII (Remedial Measures) and VIII (Reports on Compliance), only copies of the transmittal letters need be provided.

As to the City of Quincy, Massachusetts

Office of the Mayor
City of Quincy
Quincy City Hall
1305 Hancock Street
Quincy, MA 02169

City Solicitor
City of Quincy
Quincy City Hall
1305 Hancock Street
Quincy, MA 02169

Commissioner of Public Works
City of Quincy
55 Sea Street
Quincy, MA 02169

The City shall make an electronic copy of each submission that has been Approved by EPA in accordance with this Consent Decree, including Compliance Reports, available on a publicly accessible website. The City shall provide complete copies to MassDEP of all submissions and notices required to be submitted to EPA pursuant to this Consent Decree:

Kevin Brander
Section Chief
Wastewater Management Section
Massachusetts Department of Environmental Protection
Northeast Region
205B Lowell Street
Wilmington, MA 01887
kevin.brander@state.ma.us

66. All written reports and other submissions required of the City by this Consent Decree shall contain the following certification by a duly authorized representative of the City:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

XV. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS

67. This Consent Decree resolves the civil claims of the United States for the violations alleged in the Complaint filed in this action through the Date of Lodging.

68. This Consent Decree is neither a permit nor a modification of any existing permit under any federal, Commonwealth, or local law or regulation. The City is responsible for achieving and maintaining complete compliance with all applicable federal, Commonwealth, and local laws and regulations, and permits, and the City's compliance with this Consent Decree shall be no defense to any action commenced pursuant to any such laws, regulations, or permits, except as set forth herein. The United States does not, by its consent to the entry of this Consent Decree, warrant or aver in any manner that the City's compliance with any aspect of this Consent Decree will result in compliance with provisions of the CWA or with any other provisions of federal, Commonwealth, or local laws, regulations or permits. This Consent Decree shall not be construed to constitute EPA approval of any equipment or technology installed by the City under the terms of this Consent Decree.

69. This Consent Decree does not limit any rights or remedies available to the United States for any violation by the City of the CWA or associated regulations or permit conditions other than those claims alleged in the Complaint through the Date of Lodging. This Consent Decree does not limit any rights or remedies available to the United States for any criminal violations. The United States reserves all rights and remedies, legal and equitable, available to enforce the provisions of this Consent Decree. Nothing herein shall be construed to limit the power of the United States, consistent with its authorities, to undertake any action against any

person, in response to conditions which may present an imminent and substantial endangerment to the public's health or welfare, or the environment.

70. In any subsequent administrative or judicial proceeding initiated by the United States for injunctive relief, civil penalties, or other appropriate relief relating to the City's Collection System or MS4, or the City's violations of federal or Commonwealth law, the City shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim preclusion, claim-splitting, or other defenses based upon any contention that the claims raised by the United States in the subsequent proceeding were or should have been brought in the instant case, except with respect to the claims identified in the Complaint filed in this action through the Date of Lodging.

71. This Consent Decree does not resolve any claims for contingent liability under Section 309(e) of the Clean Water Act, 33 U.S.C. § 1319(e). The United States specifically reserves any such claims against the Commonwealth.

72. This Consent Decree does not limit or affect the rights of the City or the United States against any third parties, not party to this Consent Decree, nor does it limit the rights of third parties, not party to this Consent Decree, against the City, except as otherwise provided by law.

73. This Consent Decree shall not be construed to create rights in, or grant any cause of action to, any third party not party to this Consent Decree.

XVI. COSTS

74. Each Party shall bear its own expenses, costs and attorney's fees in this action. The City shall be responsible for all expenses, costs and attorney's fees incurred by the United

States in collecting any penalties due and payable under Sections VI (Civil Penalty) and X (Stipulated Penalties) of this Consent Decree.

XVII. EFFECTIVE DATE

75. The Effective Date of this Consent Decree shall be the date upon which this Consent Decree is entered by the Court or a motion to enter the Consent Decree is granted, whichever occurs first, as recorded on the Court's docket; provided, however, that the City hereby agrees that it shall be bound to perform duties scheduled to occur prior to the Effective Date. In the event the United States withdraws or withholds consent to this Decree before entry, or the Court declines to enter the Consent Decree, then the preceding requirement to perform duties scheduled to occur before the Effective Date shall terminate.

XVIII. RETENTION OF JURISDICTION

76. The Court shall retain jurisdiction to modify and enforce the terms and conditions of this Consent Decree and to resolve disputes arising hereunder as may be necessary or appropriate for the construction or execution of this Consent Decree and to assess any stipulated penalties that may have accrued because of the City's failure to comply with any of its obligations under this Decree.

XIX. MODIFICATION

77. The terms of this Consent Decree, including any attached appendices and any schedule specified in or Approved by EPA pursuant to the Consent Decree, may be modified only by a subsequent written agreement signed by each Party. Any material modification to the terms of this Consent Decree shall be effective only upon approval of the Court. Any disputes concerning modification of this Decree shall be resolved pursuant to Section XII (Dispute

Resolution), provided, however, that, instead of the burdens of proof provided by Paragraph 59, the Party seeking the modification bears the burden of demonstrating that it is entitled to the requested modification in accordance with Federal Rule of Civil Procedure 60(b).

XX. FUNDING

78. Performance of the terms of this Consent Decree by the City is not conditioned on the receipt of any federal or Commonwealth grant funds or loans. In addition, performance is not excused by the lack of federal or Commonwealth grant funds or loans.

XXI. SEVERABILITY

79. The provisions of this Consent Decree shall be severable, and should any provision be declared by a court of competent jurisdiction to be unenforceable, the remaining provisions shall remain in full force and effect.

XXII. TERMINATION

80. After the City completes all of the requirements of Section VII (Remedial Measures) and Section VIII (Reports on Compliance), complies with all other requirements of the Consent Decree, and has paid in full the Civil Penalty, all accrued interest thereon, all accrued stipulated penalties, and all accrued interest thereon, as required by Sections VI (Civil Penalty) and X (Stipulated Penalties) of this Consent Decree, the City may serve upon the United States a Request for Termination, stating that the City has satisfied those requirements, together with all applicable supporting documentation.

81. Following receipt by the United States of the City's Request for Termination, the Parties shall confer informally concerning the Request and any disagreement that the Parties may have as to whether the City has satisfied the requirements for termination of this Consent Decree.

If the United States agrees that this Decree may be terminated, the Parties shall submit, for the Court's approval, a joint stipulation terminating the Decree.

82. If the United States does not agree that the Decree may be terminated, the City may invoke dispute resolution under Section XII (Dispute Resolution). However, the City shall not seek dispute resolution of any dispute regarding termination until sixty (60) Days after service of its Request for Termination.

XXIII. FINAL JUDGMENT

83. Entry of this Consent Decree constitutes Final Judgment under Rule 54 of the Federal Rules of Civil Procedure.

XXIV. PUBLIC COMMENT

84. This Consent Decree shall be lodged with the Court for a period of not less than thirty (30) Days for public notice and comment in accordance with 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if the comments received disclose facts or considerations which indicate that this Consent Decree is inappropriate, improper or inadequate. The City consents to the entry of this Consent Decree without further notice and agrees not to withdraw from or oppose entry of this Consent Decree by the Court or to challenge any provision of this Decree, unless the United States has notified the City in writing that it no longer supports entry of this Decree.

XXV. SIGNATORIES

85. Each undersigned representative certifies that he or she is fully authorized to enter into the terms and conditions of this Consent Decree and to execute and legally bind the Party he or she represents to this document.

XXVI. INTEGRATION

86. This Consent Decree may be signed in counterparts, and its validity shall not be challenged on that basis.

87. This Consent Decree constitutes the final, complete, and exclusive agreement and understanding among the Parties with respect to the settlement embodied in the Decree and supersedes all prior agreements and understandings, whether oral or written, concerning the settlement embodied herein. Other than submissions that are subsequently submitted and Approved by EPA pursuant to this Decree, no other document, nor any representation, inducement, agreement, understanding, or promise, constitutes any part of this Decree or the settlement it represents, nor shall it be used in construing the terms of this Decree.

XXVII. APPENDICES

88. The following appendices are attached to and part of this Consent Decree:

a. "Appendix A" is EPA's "Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary Sewer Collection Systems," EPA 305-B-05-002, January 2005.

b. "Appendix B" is EPA Region 1's "Wastewater Collection System CMOM Program Self-Assessment Checklist," February 2020.

c. "Appendix C" is EPA Region 1's "EPA New England Bacterial Source Tracking Protocol," January 2012 Draft.

d. "Appendix D" is "EPA MS4 Outfall and Water Quality Data Collected in Quincy, MA," 2009-2020.

Judgment is hereby entered in accordance with the foregoing Consent Decree this 4th day of August, 2021.

RICHARD G. STEARNS
United States District Judge
District of Massachusetts

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of *United States of America v. City of Quincy*.

For Plaintiff UNITED STATES OF AMERICA

NATHANIEL R. MENDELL
Acting United States Attorney
District of Massachusetts

SUSAN POSWISTILO Digitally signed by SUSAN POSWISTILO Date: 2021.06.08 09:34:34 -04'00'

SUSAN M. POSWISTILO
Assistant U.S. Attorney
John Joseph Moakley Courthouse
One Courthouse Way
Suite 9200
Boston, Massachusetts 02210
(617) 748-3103
Susan.Poswistilo@usdoj.gov

Date

JEAN E. WILLIAMS
Acting Assistant Attorney General
Environment and Natural Resources Division

DAVID GORDON Digitally signed by DAVID GORDON Date: 2021.06.07 16:30:23 -04'00'

DAVID L. GORDON
DONALD G. FRANKEL
Senior Counsel
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044-7611
(202) 514-3659
David.L.Gordon@usdoj.gov

Date

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of *United States of America v. City of Quincy*.

For the UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Nathan Mark Pollins Digitally signed by Nathan Mark Pollins Date: 2021.05.11 11:22:23 -04'00'

MARK POLLINS
Director
Water Enforcement Division
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance
United States Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Date

DANE WILSON Digitally signed by DANE WILSON Date: 2021.05.11 09:16:39 -04'00'

DANE A. WILSON
Attorney
Water Enforcement Division
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance
United States Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Date

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of *United States of America v. City of Quincy*.

For the UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CARL DIERKER Digitally signed by CARL DIERKER
Date: 2021.04.21 17:01:06 -04'00'

CARL F. DIERKER
Regional Counsel
U.S. Environmental Protection Agency, Region 1
5 Post Office Square, Suite 100
Boston, Massachusetts 02109-3912

Date

MANCHAK NG Digitally signed by MANCHAK NG
Date: 2021.04.16 16:21:48 -04'00'

MAN CHAK NG
Senior Enforcement Counsel
Office of Regional Counsel
U.S. Environmental Protection Agency, Region 1
5 Post Office Square, Suite 100
Boston, Massachusetts 02109-3912
ng.manchak@epa.gov

Date

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of *United States of America v. City of Quincy*.

For Defendant CITY OF QUINCY

April 16, 2021

JAMES S. TIMMINS, ESQ.
City Solicitor
City of Quincy
Quincy City Hall
1305 Hancock Street
Quincy, Massachusetts 02169

Date

April 16, 2021

GARY M. RONAN
CARLA A. REEVES
Goulston & Storrs PC
400 Atlantic Avenue
Boston, Massachusetts 02110-3333
(617) 482-1776
gronan@goulstonstorrs.com
creeves@goulstonstorrs.com

Date

APPENDIX A

"Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary Sewer Collection Systems"
EPA 305-B-05-002, January 2005

GUIDE FOR EVALUATING CAPACITY, MANAGEMENT, OPERATION, AND MAINTENANCE (CMOM) PROGRAMS AT SANITARY SEWER COLLECTION SYSTEMS

United States
Environmental Protection
Agency

Office of Enforcement and
Compliance Assurance (2224A)

EPA 305-B-05-002

www.epa.gov

January 2005

TABLE OF CONTENTS

1. Introduction 1-1
1.1 Purpose of This Guide 1-1
1.2 Terminology 1-1
1.3 How to Use the Guide 1-2
1.4 Overview of Underlying Issues 1-3
1.5 Purpose of CMOM Programs 1-4
1.6 National Pollutant Discharge Elimination System Regulatory Requirement 1-5
1.7 EPA Region 4 MOM Programs Project 1-6

2. Collection System Capacity, Management, Operation, and Maintenance Programs 2-1
2.1 Collection System Management 2-4
2.1.1 Organizational Structure 2-4
2.1.2 Training 2-10
2.1.3 Internal Communication 2-11
2.1.4 Customer Service 2-11
2.1.5 Management Information Systems 2-13
2.1.6 SSO Notification Program 2-14
2.1.7 Legal Authority 2-15
2.2 Collection System Operation 2-17
2.2.1 Budgeting 2-18
2.2.2 Monitoring 2-19
2.2.3 Hydrogen Sulfide Monitoring and Control 2-20
2.2.4 Safety 2-21
2.2.5 Emergency Preparedness and Response 2-22
2.2.6 Modeling 2-24
2.2.7 Mapping 2-25
2.2.8 New Construction 2-26
2.2.9 Pump Stations 2-26
2.3 Equipment and Collection System Maintenance 2-27
2.3.1 Maintenance Budgeting 2-28
2.3.2 Planned and Unplanned Maintenance 2-28
2.3.3 Sewer Cleaning 2-33
2.3.4 Parts and Equipment Inventory 2-35
2.4 Sewer System Capacity Evaluation - Testing and Inspection 2-36
2.4.1 Flow Monitoring 2-37
2.4.2 Sewer System Testing 2-38
2.4.3 Sewer System Inspection 2-39
2.5 Sewer System Rehabilitation 2-41

3.0 Checklist for Conducting Evaluations of Wastewater Collection System Capacity, Management, Operation, and Maintenance (CMOM) Programs 3-1

Appendix A Example Collection System Performance Indicator Data Collection Form A-1
Appendix B Example Interview Schedule and Topics B-1

Appendix C Information Sources C-1

References R-1

CHAPTER 1. INTRODUCTION

1.1 Purpose of this Guide

This guide identifies some of the criteria used by EPA to evaluate a collection system's management, operation, and maintenance (CMOM) program activities. The guide is intended for use by EPA and state inspectors as well as the regulated community – owners or operators of sewer systems collecting domestic sewage as well as consultants or other third-party evaluators or compliance assistance providers. Collection system owners or operators can review their own systems by following the checklist in Chapter 3 to reduce the occurrence of sewer overflows and improve or maintain compliance. The guidance herein may also be taken a step further. If a federal or state reviewer observes a practice that does not effectively meet the elements of a CMOM program, he or she may make recommendations to educate the operator, inspector, case developer, or those involved in a settlement agreement. Additionally, having key board members (policy makers) read this guide will also allow them to better understand the benefits of investing in good CMOM programs.

The guide is applicable to small, medium, and large systems; both publicly and privately owned systems; and both regional and satellite collection systems. Regardless of size, each owner or operator will have an organization and practices unique to its collection system. While these specific characteristics will vary among systems, the CMOM concepts and best management practices are likely to apply to all types of systems. Where appropriate, this document provides guidance on the differences.

This document does not, however, substitute for the CWA or EPA's regulations, nor is it a regulation itself. Thus, the document does not and cannot impose legally binding requirements upon these circumstances. EPA and state decision-makers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. EPA may change this guidance in the future.

Individuals reviewing a collection system are strongly encouraged to read the guidance portion of this document prior to conducting a review. Reviewers should use the checklist in Chapter 3 as the primary tool for questions during the paperwork and/or onsite review of the collection system.

While some sections or topics may not appear to relate directly to environmental performance, taken as a whole, they provide an indication of how well the utility is run.

1.2 Terminology

To provide a more user-friendly guidance and for clarification, the terminology for several terms has been modified. The following paragraphs list these terms and reasoning for the modifications.

Frequently, the term "COLLECTION SYSTEM OWNER OR OPERATOR", abbreviated as "OWNER OR OPERATOR," is used in this guide and refers to the entities responsible for the administration and oversight of the sewer system and its associated staff (in either a municipal or industrial context); capacity evaluation, management, operation, and maintenance programs; equipment; and facilities. The owner and operator may be two different entities. For example, the owner may own the infrastructure and be responsible for its maintenance while it designates responsibility for the day to day operation of

the system to the operator. It should be noted that the term used in EPA's CMOM Program Self Assessment Checklist is "MUNICIPAL WASTEWATER UTILITY OPERATORS" or "UTILITY" rather than "collection system owner or operator." Both refer to the same individual(s).
The term "REVIEW" is used in this document in place of "INSPECTION" or "AUDIT." Because "inspection" often refers to an evaluation conducted by the regulatory authority and "audit" has been used to refer to an evaluation with very specific requirements, "review" is more appropriately used to capture the wider universe of evaluations (e.g., those conducted by a regulatory authority, the system itself, and/or by a third-party).

Similarly, the term used to describe the person conducting the CMOM review is the "REVIEWER" – this could be either an inspector, a third party reviewer hired by the owner or operator, or personnel of the owner or operator performing a self-evaluation of the collection system.

The term "FACILITY" is used in this document to refer to the components of the collection system (e.g., pump stations, sewer lines).

1.3 How to Use the Guide

The guide and checklist provide a three-tiered approach to the CMOM review:

- Evaluation of the CMOM program, based on interviews with management and field personnel, as well as observation of routine activities and functions
- Review of pertinent records and information management systems
- Evaluation based on field/site review

Chapter 2 provides a breakdown and overview of each CMOM concept and what to look for when reviewing the system, defines the CMOM elements for the reviewer, and follows through with a discussion of the indicators or other clues about which the reviewer should be aware. Chapters 2 and 3 present detailed information on conducting reviews of collection systems. Chapter 3 contains the comprehensive reviewer checklist, supported by the information in Chapter 2. Appendix A presents a Collection System Performance Indicator Data Collection Form which provides examples of the types of information a reviewer should attempt to obtain while on-site.

The "one size does not fit all" approach to reviewing CMOM programs cannot be overstated. The principles covered in this guide are applicable to all wastewater collection systems, however, these principles may be implemented through different means depending on the system. Larger systems may have the resources and the need to implement more costly and complex means of meeting the CMOM program elements. In occasional cases a CMOM feature may not be implemented at all, due to characteristics of the system. A reviewer should be able to look at the system as a whole and determine whether certain key elements are present or should be present and to what extent the system incorporates the CMOM principles.

Reviewers will also find that the location or names of some documents, logs, or reports may vary from system to system. This guide tries to provide a general description of the materials the reviewer should request.

Although use of this guide cannot guarantee a collection system will avoid permit violations or discharge violations, generally, when owners or operators adequately practice the principles laid out in the guide, they should experience fewer problems and, therefore, fewer instances of noncompliance.

1.4 Overview of the Underlying Issues

Sanitary sewer collection systems are designed to remove wastewater from homes and other buildings and convey it to a wastewater treatment plant. The collection system is a critical element in the successful performance of the wastewater treatment process. EPA estimates that collection systems in the U.S. have a total replacement value between $1 to $2 trillion. Under certain conditions, poorly designed, built, managed, operated, and/or maintained systems can pose risks to public health, the environment, or both. These risks arise from sanitary sewer overflows (SSOs) from the collection system or by compromised performance of the wastewater treatment plant. Effective and continuous management, operation, and maintenance, as well as ensuring adequate capacity and rehabilitation when necessary, are critical to maintaining collection system capacity and performance while extending the life of the system.

EPA believes that every sanitary sewer system has the capacity to have an SSO. This may be due to a number of factors including, but not limited to:

- Blockages
- Structural, mechanical, or electrical failures
- Collapsed or broken sewer pipes
- Insufficient conveyance capacity
- Vandalism

SSOs include untreated discharges from sanitary sewer systems that reach waters of the United States (photo: US EPA).

Additionally, high levels of inflow and infiltration (I/I) during wet weather can cause SSOs. Many collection systems that were designed according to industry standards experience wet weather SSOs because levels of I/I may exceed levels originally expected; prevention of I/I has proven more difficult and costly than anticipated; or the capacity of the system has become inadequate due to an increase in service population without corresponding system upgrades (EPA 2004).

SSOs can cause or contribute to environmental and human health impacts (e.g., water quality standards violations, contamination of drinking water supplies, beach closures, etc.) which, in addition to flooded basements and overloaded wastewater treatment plants, are some symptoms of collection systems with inadequate capacity and improper management, operation, and maintenance. These problems create the need for both the owner or operator and the regulatory authority to conduct more thorough evaluations of sanitary sewer collection systems.

1.5 Purpose of CMOM Programs

CMOM programs incorporate many of the standard operation and maintenance activities that are routinely implemented by the owner or operator with a new set of information management requirements in order to:

- Better manage, operate, and maintain collection systems
- Investigate capacity constrained areas of the collection system
- Proactively prevent SSOs
- Respond to SSO events

The CMOM approach helps the owner or operator provide a high level of service to customers and reduce regulatory noncompliance. CMOM can help utilities optimize use of human and material resources by shifting maintenance activities from "reactive" to "proactive"–often leading to savings through avoided costs due to overtime, reduced emergency construction costs, lower insurance premiums, changes in financial performance goals, and fewer lawsuits. CMOM programs can also help improve communication relations with the public, other municipal works and regional planning organizations, and regulators.

It is important to note that the collection system board members or equivalent entity should ensure that the CMOM program is established as a matter of policy. The program should not be micro-managed, but an understanding of the resources required of the operating staff to implement and maintain the program is necessary.

In CMOM planning, the owner or operator selects performance goal targets, and designs CMOM activities to meet the goals. The CMOM planning framework covers operation and maintenance (O&M) planning, capacity assessment and assurance, capital improvement planning, and financial management planning. Information collection and management practices are used to track how the elements of the CMOM program are meeting performance goals, and whether overall system efficiency is improving.

On an periodic basis, utility activities should be reviewed and adjusted to better meet the performance goals. Once the long-term goal of the CMOM program is established, interim goals may be set. For instance, an initial goal may be to develop a geographic information system (GIS) of the system. Once the GIS is complete, a new goal might be to use the GIS to track emergency calls and use the information to improve maintenance planning.

An important component of a successful CMOM program is periodically collecting information on current systems and activities to develop a "snapshot-in-time" analysis. From this analysis, the owner or operator evaluates its performance and plans its CMOM program activities.

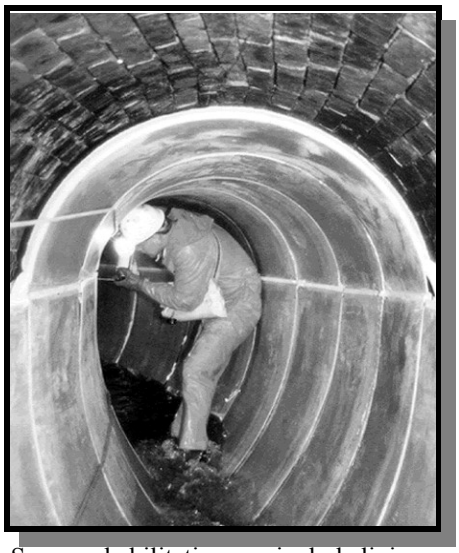
Maintaining the value of the investment is also important. Collection systems represent major capital investments for communities and are one of the communities' major capital assets. Equipment and facilities will deteriorate through normal use and age. Maintaining value of the capital asset is a major goal of the CMOM program. The infrastructure is what produces sales and service. Proper reinvestment in capital facilities maintains the ability to provide service and generate sales at the least cost possible and helps ensure compliance with environmental requirements. As a capital asset, this will result in the

need for ongoing investment in the collection system and treatment plant to ensure design capacity while maintaining existing facilities and equipment as well as extending the life of the system.

The performance of wastewater collection systems is directly linked to the effectiveness of its CMOM program. Performance characteristics of a system with an inadequate CMOM program include frequent blockages resulting in overflows and backups. Other major performance indicators include pump station reliability, equipment availability, and avoidance of catastrophic system failures such as a collapsed pipe.

A CMOM program is what an owner or operator should use to manage its assets; in this case, the collection system itself. The CMOM program consists of a set of best management practices that have been developed by the industry and are applied over the entire life cycle of the collection system and treatment plant. These practices include:

- Designing and constructing for O&M
- Knowing what comprises the system (inventory and physical attributes)
- Knowing where the system is (maps and location)
- Knowing the condition of the system (assessment)
- Planning and scheduling work based on condition and performance
- Repairing, replacing, and rehabilitating system components based on condition and performance
- Managing timely, relevant information to establish and prioritize appropriate CMOM activities
- Training of personnel



Sewer rehabilitation can include lining aging sewers (photo: NJ Department of Environmental Protection).

1.6 National Pollutant Discharge Elimination System Regulatory Requirement

The National Pollutant Discharge Elimination System (NPDES) program prohibits discharges of pollutants from any point source into the nation's waters except as authorized under an NPDES permit. EPA and state NPDES inspectors evaluate collection systems and treatment plants to determine compliance with permit conditions including proper O&M. Among others, these permit conditions are based on regulation in 40 CFR 122.41(e): "The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit."

When violations occur, the collection system or wastewater treatment plant owner or operator can face fines and requirements to implement programs to compensate residents and restore the environment. For example, in June 2004, the U.S. District Court for the Southern District of Ohio entered a consent decree resolving CSO, SSO, and wastewater treatment plant violations at the Hamilton County sewer system in Cincinnati, Ohio. In addition to a $1.2 million civil penalty, the settlement included programs to clean up residents' basements, compensate residents, and implement measures to prevent further basement backups. The settlement also includes over $5.3 million in supplemental environmental projects.

1.7 EPA Region 4 MOM Programs Project

EPA Region 4 created the "Publicly Owned Treatment Works MOM Programs Project" under which the Region invites permitted owners or operators, and contributing satellite systems, in watersheds it selects to perform a detailed self-assessment of the management, operation, and maintenance (MOM) programs associated with their collection system. Participants provide a report which includes the results of the review, any improvements that should be made, and schedules to make those improvements. Participants that identify and report a history of unpermitted discharges from their collection system, and a schedule for the necessary improvements, can be eligible for smaller civil penalties while under a remediation schedule.

EPA's Office of Compliance coordinated with EPA Region 4 on the development of this CMOM Guide. This guide is based in part on material obtained from the Region 4 MOM Programs Project. Some of the more specific items of the Region 4 program have been omitted in order to provide a more streamlined review framework. The fundamental concepts behind CMOM have been maintained in this guide. By combining elements of the Region's program with existing NPDES inspection guidance, this CMOM Guide provides a comprehensive framework for reviewers and regulated communities to evaluate the effectiveness of O&M throughout the collection system.

CHAPTER 2. COLLECTION SYSTEM CAPACITY, MANAGEMENT, OPERATION, AND MAINTENANCE PROGRAMS

This chapter provides an overview of the CMOM program elements. The information will help evaluate wastewater collection system operation and maintenance (O&M) practices. The key elements of the CMOM program, which are presented in detail in the following sections, include:

- Collection System Management
- Collection System Operation
- Collection System Maintenance
- Collection System Capacity Evaluation

In addition to this overview, there are several areas (e.g., 2.1.3 Internal Communications, 2.1.4 Customer Service, etc.) in this guide that go into greater depth regarding the operation and maintenance of a collection system. The intent of this detail is not only to provide the owner or operator with suggestions as to what to look for in their own program, but to provide the reviewer a complete overview of good operations, in general, regardless of a particular item resulting in poor performance or a violation.

For EPA and state inspectors or other reviewers, conducting an evaluation of collection system CMOM programs shares many similarities with other types of compliance reviews. Overall, the reviewer would examine records, interview staff and conduct field investigations, generally in that order although tailored, if necessary, to meet site-specific needs. Prior to performing the on-site interviews and evaluations, preliminary information may be requested that will provide an overall understanding of the organization to allow for a more focused approach for the review. This information also provides a basis for more detailed data gathering during on site activities. The information typically requested prior to the review should include a schematic map of the collection system (could be as-built drawings) and any written operations or maintenance procedures. Depending on the volume of information, the collection system owner or operator may need ample lead time to gather and copy these documents. Alternatively, the reviewer may offer to examine the documents and bring them back when doing the on-site review so that extra copies are not necessary. No matter which method is used, the importance of up-front preparation cannot be overemphasized. With the exception of pump stations and manholes, much of the collection system is not visible. Therefore, the more complete the reviewer's understanding of the system is prior to the review, the more successful the assessment will be.

The reviewer would then proceed with the on-site activities. Guidance for conducting compliance reviews is provided in the *NPDES Compliance Inspection Manual* (EPA 2004). The manual provides the general procedures for performing compliance reviews and is a valuable source of information on such topics as entry, legal authority, and responsibilities of the reviewer. Although CMOM evaluations are not specifically addressed in the manual, the general

review procedures can be applied to CMOM reviews. Another good reference for general review information is the *Multi-Media Investigations Manual, NEIC* (EPA 1992). Some issues with entry are specific to CMOM reviews. Some facilities may be on private property and the reviewer may need property owner consent for entry.

***Documents to Review On-site Include*:**

- Organization chart(s)
- Staffing plans
- Job descriptions
- Sewer use ordinance
- Overall map of system showing facilities such as pump stations, treatment plants, major gravity sewers, and force mains
- O&M budget with cost centers[1] for wastewater collection
- Performance measures for inspections, cleaning, repair, and rehabilitation
- Recent annual report, if available
- Routine reports regarding system O&M activities
- Collection system master plan
- Capital improvement projects (CIP) plan
- Flow records or monitoring
- Safety manual
- Emergency response plan
- Management policies and procedures
- Detailed maps/schematics of the collection system and pump stations
- Work order management system
- O&M manuals
- Materials management program
- Vehicle management and maintenance records
- Procurement process
- Training plan for employees
- Employee work schedules
- Public complaint log
- Rate ordinance or resolution
- Financial report ("notes" section)
- As built plans
- Discharge monitoring reports (DMRs)

The above list is not all inclusive nor will all utilities necessarily have formal, written documentation for each of the items listed. The *Collection System Performance Indicator Data Collection Form*, included as Appendix A, provides examples of the types of information a reviewer should attempt to obtain while on-site.

Interviews are generally conducted with line managers and supervisors who are responsible for the various O&M activities

Reviewer - Point to Note
A schedule should be established by the reviewer for the staff interviews and field assessments.

[1] A cost center is any unit of activity, group of employees, line of products, etc., isolated or arranged in order to allocate and assign costs more easily.

and support services staff from engineering, construction, human resources, and purchasing, where appropriate. Appendix B presents an example agenda and schedule that would be used for a large collection system owner or operator. The collection system's size and physical characteristics will determine the length of time needed for the review. A guideline for the time required, given a two person review team, would be two days for a small system, and a week or more for large systems.

Field reviews are typically conducted after interviews. The following is a list of typical field sites the team should visit:

- Mechanical and electrical maintenance shop(s)
- Fleet maintenance facilities (vehicles and other rolling stock)
- Materials management facilities (warehouse, outside storage yards)
- Field maintenance equipment storage locations (i.e., crew trucks, mechanical and hydraulic cleaning equipment, construction and repair equipment, and television inspection equipment)
- Safety equipment storage locations
- Pump stations
- Dispatch and supervisory control and data acquisition (SCADA) systems
- Crew and training facilities
- Chemical application equipment and chemical storage areas (use of chemicals for root and grease control, hydrogen sulfide control [odors, corrosion])
- Site of SSOs, if applicable
- A small, but representative, selection of manholes

Collection system operators typically assist with manhole cover removal and other physical activities. The inspector should refrain from entering confined spaces. A confined space is defined by the Occupational Safety and Health Administration (OSHA) as a space that: (1) is large enough and so configured that an employee can bodily enter and perform assigned work; and (2) has limited or restricted means for entry or exit; and (3) is not designed for continuous employee occupancy [29 CFR 1910.146(b)]. A "permit-required confined space (permit space)" is a confined space that has one or more of the following characteristics: (1) contains or has a potential to contain a hazardous atmosphere; (2) contains a material that has the potential for engulfing an entrant; (3) has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or (4) contains any other recognized serious safety or health hazard [29 CFR 1910.146(b)].

Though OSHA has promulgated standards for confined spaces, those standards do not apply directly to municipalities, except in those states that have approved plans and have asserted jurisdiction under Section 18 of the OSHA Act. Contract operators and private facilities do have to comply with the OSHA requirements and the inspector may find that some municipalities elect to do so voluntarily. In sewer collection systems, the two most common confined spaces are the underground pumping station and manholes. The underground pumping station is typically entered through a relatively narrow metal or concrete shaft via a fixed ladder. Inspectors conducting the field evaluation component of the CMOM audit should be able to identify and

avoid permit-required confined spaces. Although most confined spaces are unmarked, confined spaces that may have signage posted near their entry containing the following language:

DANGER–PERMIT REQUIRED–CONFINED SPACE
AUTHORIZED PERSONNEL ONLY

If confined space entry is absolutely necessary, inspectors should consult with the collection system owner or operator first, have appropriate training on confined space entry, and use the proper hazard detection and personal safety equipment. More information on confined space entry can be found in *Operation and Maintenance of Wastewater Collection Systems Volumes I and II* (California State University (CSU) Sacramento 1996; CSU Sacramento 1998).

2.1 Collection System Management

Collection system management activities form the backbone for operation and effective maintenance activities. The goals of a management program should include:

- Protection of public health and prevention of unnecessary property damage
- Minimization of infiltration, inflow and exfiltration, and maximum conveyance of wastewater to the wastewater treatment plant
- Provision of prompt response to service interruptions
- Efficient use of allocated funds
- Identification of and remedy solutions to design, construction, and operational deficiencies
- Performance of all activities in a safe manner to avoid injuries

Management Documents to Review

- Organization chart(s)
- Staffing plans–Number of people and classifications
- Job descriptions for each classification
- Sewer use ordinance
- Safety manual
- Training program documentation
- Notes to financial reports

Without the proper procedures, management and training systems, O&M activities may lack organization and precision, resulting in a potential risk to human health and environmental contamination of surrounding water bodies, lands, dwellings, or groundwater. The following sections discuss the common elements of a robust collection system management program.

2.1.1 Organizational Structure

Well-established organizational structure, which delineates responsibilities and authority for each position, is an important component of a CMOM program for a collection system. This information may take the form of an organizational chart or narrative description of roles and

responsibilities, or both. The organizational chart should show the overall personnel structure, including operation and maintenance staff. Additionally, up-to-date job descriptions should be available. Job descriptions should include the nature of the work performed, the minimum requirements for the position, the necessary special qualifications or certifications, examples of the types work, lists of licences required for the position, performance measures or promotion potential. Other items to note in regard to the organizational structure are the percent of staff positions currently vacant, on average, the length of time positions remain vacant, and the percent of collection system work that is contracted out.

Reviewer - Point to Note
The reviewer may want to note the turnover rate and current levels of staffing (i.e., how many vacant positions exist and for how long they have been vacant). This may provide some indication of potential understaffing, which can create response problems.

Reviewers should evaluate specific qualifications of personnel and determine if the tasks designated to individuals, crews, or teams match the job descriptions and training requirements spelled out in the organizational structure. From an evaluation standpoint, the reviewer might try to determine what type of work is performed by outside contractors and what specific work is reserved for collection system personnel. If much of the work is contracted, it is appropriate to review the contract and to look at the contractor's capabilities. If the contractor handles emergency response, the reviewer should examine the contract with the owner or operator to determine if the emergency response procedures and requirements are outlined.

The inclusion of job descriptions in the organizational structure ensures that all employees know their specific job responsibilities and have the proper credentials. Additionally, it is useful in the course of interviews to discuss staff management. The reviewer should note whether staff receive a satisfactory explanation of their job descriptions and responsibilities. In addition, when evaluating the CMOM program, job descriptions will help a reviewer determine who should be interviewed.

Reviewer - Point to Note
A reviewer should look for indications that responsibilities are understood by employees. Such indications may include training programs, meetings between management and staff, or policies and procedures.

When evaluating the organizational structure, the reviewer should look for the following:

- Except in very small systems, operation and maintenance personnel ideally should report to the same supervisor or director. The supervisor or director should have overall responsibility for the collection system.

- In some systems, maintenance may be carried out by a city-wide maintenance

organization, which may also be responsible for such diverse activities as road repair and maintenance of the water distribution system. This can be an effective approach, but only if adequate lines of responsibility and communication are established.

- In general, one supervisor should manage a team of individuals small enough that is safe and effective. However, the individuals on the team may have additional employees reporting to them. This prevents the top supervisors from having to track too many individuals. The employee-supervisor ratio at individual collection systems will vary depending on their need for supervisors.

In a utility with well-established organizational structure, staff and management should be able to articulate their job and position responsibilities. Personnel should be trained to deal with constantly changing situations and requirements, both regulatory and operational.

The system's personnel requirements vary in relation to the overall size and complexity of the collection system. In very small systems, these responsibilities may include operation of the treatment plant as well as the collection system. In many systems, collection system personnel are responsible for the stormwater as well as wastewater collection system. References providing staff guidelines or recommendations are available to help the reviewer determine if staffing is adequate for the collection system being reviewed. Following is a list of available references:

- *Manpower Requirements for Wastewater Collection Systems in Cities of 150,000 to 500,000 Population* (EPA 1974)
- *Manpower Requirements for Wastewater Collection Systems in Cities and Towns of up to 150,000 Population* (EPA 1973)
- *Operation and Maintenance of Wastewater Collection Systems*, Volume II (California State University (CSU) Sacramento 1998)

Volumes I and II of *Operations and Maintenance of Wastewater Collection Systems* can be obtained through:

Office of Water Programs
California State University Sacramento
6000 J Street
Sacramento, CA 95819-6025
phone: 916/278-6142
www.owp.csus.edu

The following tables have been taken from the two EPA documents listed above to provide the reviewer with guidance. However, these documents may not take into account technological advances that have occurred since their publication date that might reduce staffing requirements. For instance, advances in remote data acquisition and telemetry have likely reduced the number

of field inspection staff needed for systems with several pump stations. Other system-specific characteristics should also be accounted for when using these tables. An example of this might be collection systems that are not primarily constructed of brick will not require the masons the tables specify.

STAFF COMPLEMENTS FOR WASTEWATER COLLECTION SYSTEM MAINTENANCE
POPULATION SIZE
(Estimated Number of Personnel)

Occupational Title	5,000		10,000		25,000		50,000		100,000	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Superintendent	1	5	1	10	1	20	1	40	1	40
Assistant Superintendent										
Maintenance Supervisor							1	40	2	80
Foreman	1	15	1	20	1	20	1	40	1	40
Maintenance Man II	1	15	1	20	1	20	1	40	1	40
Maintenance Man I	1	15	1	20	2	60	3	120	5	200
Mason II							1	40	1	40
Mason I									1	40
Maint. Equipment Personnel					1	40	2	80	3	120
Construction Equipment Personnel	1	15	1	20	1	20	1	40	1	40
Auto. Equipment Personnel									1	40
Photo. Inspection Technician									1	40
Laborer	1	15	1	20	2	40	2	80	5	200
Dispatcher							1	40	2	80
Clerk Typist							1	20	1	20
Stock Clerk							1	40	1	40
Sewer Maint. Staff	6	80	6	110	9	220	16	620	27	1,060
Maintenance Mechanic II	see comment (c) below									
Maintenance Mechanic I	see comment (d) below									
Maintenance Mechanic Helper	see comment (d) below									
Construction Inspection Supervisor	see comments (e) and (f) below									
Total Staff										

(a) Estimated number of personnel.
(b) Estimated total man-hours per week.
(c) Multiply number of lift stations maintained by 8/3.
(d) Multiply number of lift station visits per week by 1.
(e) Multiply estimated construction site visits per week by 8/3.
(f) Determined by the number of Construction Inspectors employed and developed on a judgmental basis.

Unit processes included in this staffing table are:

1. Maintenance of sanitary sewer main lines & appurtenances (laterals not included).
2. Maintenance of storm sewer main lines.
3. Maintenance of lift stations.
4. Inspection of newly constructed sewer main lines and appurtenances.

(U.S. EPA 1973)

STAFF COMPLEMENTS FOR WASTEWATER COLLECTION SYSTEM MAINTENANCE
POPULATION SIZE
(Estimated Number of Personnel)

Occupational Title	150,000	200,000	300,000	400,000	500,000
Superintendent	1	1	1	1	1
Assistant Superintendent	1	1	1	1	1
Maintenance Supervisor II	1	1	1	1	1
Maintenance Supervisor I	1	2	2	3	3
Equipment Supervisor	1	1	1	1	1
TV Technician II	1	2	2	3	3
TV Technician I	1	2	2	3	3
Foreman	2	3	4	5	6
Maintenance Man II	3	5	6	8	9
Maintenance Man I	11	17	22	29	33
Mason II	1	2	2	3	3
Mason I	1	2	2	3	3
Maintenance Equipment Personnel	6	8	12	15	18
Construction Equipment Personnel	3	4	6	8	9
Auto. Equipment Personnel	2	3	4	5	6
Laborer	7	10	14	18	22
Dispatcher	2	2	2	3	3
Stock Clerk	1	2	2	3	3
Clerk Typist	2	2	2	3	3
Sewer Maintenance Staff	48	70	88	116	131
Maintenance Mechanic II	see comment (a) below				
Maintenance Mechanic I	see comment (b) below				
Maintenance Mechanic Helper	see comment (b) below				
Electrician	see comment (c) below				
Construction Inspector Supervisor	see comment (d) below				
Construction Inspector	see comment (e) below				
Total Staff					

(a) Divide number of lift stations maintained by 15.
(b) Divide number of lift station visits per week by 40
(c) Divide number of lift stations maintained by 15.
(d) Determined by the number of Construction Inspectors employed and developed on a judgmental basis.
(e) Divide estimated daily construction site visits by 2.

Unit processes included in this staffing table are:

1. Maintenance of sanitary sewer main lines & appurtenances (laterals not included).
2. Maintenance of storm sewer main lines.
3. Maintenance of lift stations.
4. Inspection of newly constructed main lines and appurtenances.

(U.S. EPA 1974)

2.1.2 Training

The commitment of management to training is key to a successful program. It is important to recognize training as a budget expense item. A guideline for the typical amount of funding for training is three to five percent of the gross budget for the collection system. However, in large collection systems or those undergoing extensive construction this percentage may be considerably lower, and, in systems with a high turnover, training costs may be higher due to orienting new employees. Other changes, such as incorporation of new technology, will have a short-term impact on training costs. Although training is not explicitly required under current regulations, a collection system with untrained or poorly trained collection system personnel runs a greater risk of experiencing noncompliance.

The following elements are essential for an effective training program:

- Fundamental mission, goals, and policies of the collection system are addressed
- Mandatory training requirements are identified for key employees
- On-the-job training progress and performance are measured
- Effectiveness of the training is assessed including periodic testing, drills, or demonstrations
- New employees receive training

The owner or operator should generally provide training in the following areas:

- Routine line maintenance (may be on-the-job training only)
- Safety during confined space entry (every system should also have a strict policy and permit program)
- Traffic control (where applicable)
- Record keeping
- Pump station O&M
- Electrical and instrumentation (may be a combination of formal and on-the-job training)
- Public relations and customer service
- SSO/Emergency response
- Pump station operations and maintenance
- Pipe repair; bursting or cured in place pipe (CIPP); or closed circuit TV and trench/shoring (where these activities are not outsourced)

Sources of Training

Training is required to safely perform inspections, follow replacement procedures, and lubricate and clean parts and equipment. Following are the many sources of maintenance training:

- Manufacturer
- In-house
- On-the-job (OJT)
- Industry-wide (e.g., consultants, regulatory authorities, professional associations, or educational institutions)

The training program should identify the types of training required and offered. Types of training vary, but may include general environmental awareness, specific equipment, policies and

procedures, and conducting maintenance activities. If the owner or operator is carrying out its own training, the reviewer should evaluate one or more examples of training materials to answer the following questions: are the materials appropriate to the training topic and the level of those being trained; and are they likely to accomplish the intended goal?

Owner or Operator - Point to Note
The owner or operator should routinely assess the effectiveness of training through periodic testing, drills, demonstrations, or informal reviews, and improve training based on this assessment.

2.1.3 Internal Communication

Communication is essential to ensuring that collection systems run efficiently and effectively. It is especially important that an effective communication link exists between wastewater treatment plant operators and collection system crews as well as with other municipal departments.

Effective communication requires the top-down, bottom-up, and lateral exchange of information amongst staff. Examples of top-down communication are bulletin board posters, paycheck inserts, regular staff meetings, e-mail or informal brown-bag lunch discussions. Examples of bottom-up communication may include the establishing environmental committees, confidential hotlines, e-mail, or direct open discussions. Collection system owners or operators may also offer incentives to employees for performance, and encourage them to submit suggestions for ways to improve the performance of the collection system. “Front line” employees are often an excellent source of ideas, issues, and information about how to improve performance at the work site. In this context, the reviewer can check for morale-boosting activities or reward programs, such as “Employee of the Month” and “Employee of the Year.”

The reviewer should attempt to determine lines of internal communication to ensure all employees receive information and have an appropriate forum to provide feedback. The reviewer should assess the level of communication by interviewing several levels of staff or by simply observing collection system teams on work assignments. The owner or operator should have procedures and be able to demonstrate internal communication between the various levels and functions of the collection system regarding its management, operation, and maintenance programs.

2.1.4 Customer Service

The community often knows very little about the wastewater treatment and collection services performed for them. The community may only be aware of the collection system and its owner or operator through articles in local newspapers, public radio and television announcements, or only when there is an SSO. Collection system representatives should talk to schools and universities, make presentations to local officials and businesses about the wastewater field. Formal presentations can also be given to citizens, building inspectors, public utility officials,

and members of the media.

An effective customer service and public relations program ensures that the owner or operator addresses all incoming inquiries, requests, and complaints in a timely fashion. From this information, owners or operators may further develop or revise programs to better address areas of concern. The reviewer should examine customer service records for the following:

- Personnel who received the complaint or request
- Date and nature of the complaint or request
- Location of the problem
- Name, address, and telephone number of the customer
- Cause of the problem
- To whom the follow-up action was assigned
- The initial date of the follow-up action
- Date the complaint or request was resolved
- Total days to end the problem
- Feedback to the customer

Awareness of past issues, population served, compliance history, and other elements help a reviewer determine whether the amount and types of inquiries, requests, or complaints are increasing or decreasing. For example, there may have been many complaints during only a certain week. The reviewer can examine those records to determine if there were specific circumstances (e.g., a large precipitation event) that caused the increase in inquiries or complaints.

Reviewer - Point to Note
To fully understand the context of customer inquiries, requests, or complaints, a reviewer should understand the history, topography, boundaries, and demographics of the collection system's jurisdiction before site evaluations are conducted.

Employees who handle customer service should be specifically trained to handle complaints, requests, or inquiries. These employees should be provided with sample correspondence, Q/A's, or "scripts" to help guide them through written or oral responses to customers. The reviewer should look for procedures on how to answer the telephone, e-mail, and other communication used by personnel. A reviewer may evaluate staff telephone responses by evaluating:

- The number of persons available to answer calls
- The number of repeat callers
- The average length of calls
- The volume of calls per day

Collection system field crews and their activities are the most visible segment of any wastewater treatment organization. Workers project a public image for their system on city and town streets. For this reason, personnel need to be trained in what to expect in public situations. For example,

collection system supervisory staff should be familiar with the areas around public rights-of-way and easements to which their field crews must gain access to service facilities. Additionally, crew leaders should know how to deal with the public when approached.

Collection systems field crews influence the public's confidence in the collection system owner or operator. Reviewers should observe whether personnel wear uniforms or not, and if vehicles and equipment are identifiable as utility property and kept in good working order. Vehicles should be equipped with adequate emergency lighting and flashers, traffic control signs and barriers, etc. Before major construction or maintenance work begins, owners or operators should notify homeowners where properties may be affected. Methods of notification may include door hangers, newspaper notices, fliers, signs, or public radio or television announcements. Information should also be provided to residents on cleanup and safety procedures following basement backups and other overflows.

2.1.5 Management Information Systems

The ability of the owner or operator to effectively manage its collection system is directly related to its ability to maintain access to the most current information concerning the facilities. Maintenance of this current information is an effort involving all members of the collection system from the staff answering the telephone to the worker in the street. Operational information informs and clarifies financial information. This will make the financial information more useful for the policy makers, leading to better decisions. A satisfactory management information system should provide the owner or operator with the following advantages:

A growing number of sewer systems have shifted to computer-based collection system management [photo: Milwaukee Metropolitan Sewerage District (MMSD)].

- Maintain preventive maintenance and inspection schedules
- Offer budgetary justification
- Track repairs and work orders
- Organize capital replacement plans
- Manage tools and equipment inventories
- Create purchase orders
- Record customer service inquiries, complaints, or requests
- Provide measurement of effectiveness of program and O&M activities

Owners and operators have been shifting to computer-based systems to manage data. Only the smaller collection system owners or operators may still rely on paper management systems.

Computer-based Maintenance Management Systems (CMMSs) are designed to manage the data needed to track the collection system's O&M performance. Geographic Information Systems (GIS) are used to map and locate facilities and because of computer-based compatibility, can often easily be integrated with a CMMS. The computer-based system however, can only be as accurate as the data used to develop it, which was most likely paper files.

Types of Management Information Tracking

- Customer service
- Safety incident
- Emergency response
- Process change
- Inspection scheduling and tracking
- Monitoring and/or sampling schedules
- Compliance
- Planned maintenance (schedules and work orders)
- Parts inventory

Regardless of the information management style chosen, the collection system should have written instructions regarding the use of the management information systems. These procedures may include operating the system, upgrading the system, accessing data and information, and generating and printing reports. The system should be kept current with accurate information. Work reports from the field crews should be complete, accurate, and legible.

The reviewer may select some number of complaints and see how well they can be tracked through the system to an ultimate conclusion. Work reports generated by the field crew should be randomly chosen and scanned for legibility and completeness. The reviewer should do a random check of the timeliness and accuracy of data entry. Additionally, the reviewer should obtain selected original data sources (such as field reports) and compare them to the appropriate database output to determine how long entry takes. This will provide a check on how current the database is and what data entry backlog exists.

2.1.6 SSO Notification Program

The owner or operator should maintain a written procedure indicating the entities, (e.g., drinking water purveyors, the public, public health officials, and the regulatory authority) that should be notified in the event of an SSO. The procedure should clearly indicate the chain of communication used to notify the proper personnel of an SSO event for reporting and remediation. The procedure should include the names, titles, phone numbers, and responsibility of all personnel involved. The reviewer should verify that the personnel listed in the procedure are still in the position listed and are aware of their responsibilities.

Reviewer - Point to Note
To verify the effectiveness of the notification program, the reviewer should walk an overflow occurrence report through the chain of events that would occur from the time of initial notification.

The procedure may allow for different levels of response for different types of SSOs. For example, the regulatory authority may request that SSOs due to sewer line obstructions be

reported on a monthly basis. Therefore, the procedure may simply be to gather this information from the maintenance information system and have the appropriate personnel put together a reporting form. A chronic SSO at a pump station that discharges when overloaded during wet weather may require a more complex notification procedure, including immediate telephone notification to specified authorities.

To verify the effectiveness of the notification program, the reviewer should walk an overflow occurrence report through the chain of events that would occur from the time of initial notification. This can be done by choosing several random overflow events from the complaint records and observing whether they are handled as procedures dictate. The minimum information that should be reported for an SSO includes the date, time, location, cause, volume of the overflow (which may be estimated), how it was stopped, and any remediation methods taken. The reviewer should not only verify that the SSO notification procedures are appropriate, but also verify that the owner or operator has reliable methods for the detection of overflows and a phone number or hotline for the public to report observed overflow events.

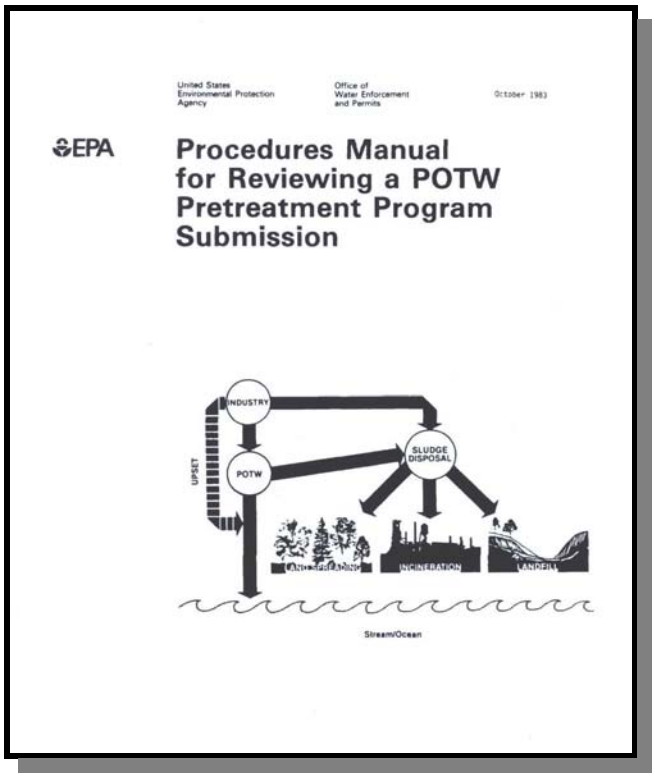
2.1.7 Legal Authority

The collection system owner or operator should select and enforce the legal authority necessary to regulate the volume of flow entering the collection system, including residential and commercial customers, satellite communities and industrial users. The legal authority may take the form of sewer use ordinances, contracts, service agreements, and other legally binding documents.

A **satellite community** is a collection systems which does not own the treatment facility to which it discharges.

The pretreatment program seeks to prevent the discharge of materials into the sewer system (by non-domestic users) that interfere with proper operation of the wastewater treatment plant or may pass through the plant untreated. At the time the operator of a wastewater treatment plant submits its pretreatment program to the regulatory authority for approval, the plant operator must include a statement from the city solicitor or other legal authority that the plant has the authority to carry out the program [40 CFR 403.9(a)(1)]. The reviewer should verify the existence of this statement and inquire as to whether any significant changes have occurred in the program such that the legal authority may need further review. Additionally, some owners or operators may have a pretreatment program approved by the state, through which discharge permits are issued to industrial users and enforcement is conducted. Further information on legal authority under the pretreatment program may be found in *Procedures Manual for Reviewing a POTW Pretreatment Program Submission* (EPA 1983).

The owner or operator should have the authority to ensure that new and rehabilitated sewers and connections have been properly designed, constructed, and tested before being put into service. This authority could take the form of design and performance specifications in a sewer use ordinance or other legal document such as a statute or series of contracts or joint powers agreements. The ordinance or legal document should contain, at a minimum, general prohibitions, adequate grease control requirements and measures, prohibitions on stormwater inflow, infiltration from laterals, and new construction standards.



The grease control section of the document should contain the requirement to install grease traps at appropriate facilities (e.g., restaurants). Additionally, these facilities should be required to properly maintain the grease traps and pump them out on a regular basis. The document should also address periodic inspections of grease traps by collection system personnel and the ability to enforce (i.e., levy fines on persistent offenders).

General Prohibitions

- Fire and explosion hazards
- Corrosive and obstructive materials
- Material which may cause interference at the wastewater treatment plant
- Heat which may inhibit biological activity at the wastewater treatment plant
- Oils or petroleum products which may cause interference or pass through the wastewater treatment plant

The owner or operator should maintain strict control over the connection of private sewer laterals to sewer mains. These connections have significant potential as sources of infiltration. Standards for new connections should be clearly specified. The sewer use ordinance should contain provisions for inspection, approval of new connections, and a program to implement the requirements. A method to maintain control over existing connections is to require an inspection of the lateral prior to sale of a property. It is important to note that implementing this type of program may require a change to the local ordinance or code.

The owner or operator should also have the legal authority to prohibit stormwater connections to the sanitary sewer. Stormwater connections may include catch basins; roof, cellar and yard drains; sump pumps; direct connections between the storm and sanitary sewers; leaking manhole covers; uncapped cleanouts; and the direct entrance of streams into the collection system. This practice is now discouraged. Direct stormwater connections to a separate sanitary sewer system are known as inflow. Inflow can severely impact the ability of the collection system to transport flows to the treatment plant during wet weather, leading to overflows and noncompliance with the wastewater treatment plant's NPDES permit.

Sources of stormwater in the collection system may include building downspouts connected directly to the system (photo: MMSD).

Satellite communities should not be allowed to contribute excessive flows that cause or contribute to overflows, flooding, or noncompliance at the wastewater treatment plant. Should any of these situations exist, it is not sufficient for the owner or operator to charge the satellite community for the excess flow. The owner or operator must be able to prohibit the contribution of the excess flow. This may be done through a legal inter-jurisdictional agreement between the wastewater treatment plant owner or operator and the satellite community that addresses allowable flows and sets requirements. The reviewer should examine all contracts between systems and their satellites (unless too numerous, then select representative contracts). Contracts should have a date of termination and allow for renewal under renegotiated terms. Contracts should limit flow from satellite communities and limit peak wet weather flow rates.

Owner or Operator - Point to Note
The owner or operator should have a comprehensive program which addresses flows from satellite communities.

2.2 Collection System Operation

Collection systems have little of what is traditionally referred to as "operability" as compared to a wastewater treatment plant (i.e., the number of ways to route the wastewater is typically limited). However, the design of some collection systems does allow flow to be diverted or routed from one pipe to another or even to different treatment plants. This can be accomplished by redirecting flow at a pump station from one discharge point to another or opening and closing valves on gravity sewers and force mains.

Owner or Operator - Point to Note
There should be detailed, written procedures available to guide owners or operators through flow routing activities. Also, there should be operating procedures for mechanical equipment such as pump station pump on/off and service rotation settings or in-line grit removal (grit trap) operations.

There are many reasons why the owner or operator may want to divert flows; among them, to relieve overloading on a system of piping or the wastewater treatment plant or to add more flow to piping serving an area not yet fully developed to maintain a cleansing velocity.

2.2.1 Budgeting

The budget is one of the most important variables in the CMOM program. Although an adequate budget is not a guarantee of a well operated collection system, an inadequate budget will make attaining this goal difficult. Funding can come from a variety of sources, including user fees or appropriations from the state or local government.

Reviewer - Point to Note
Reviewers need to determine the source of the funding for the collection system and who controls it. Reviewers should also request budget documents, summaries, or pie charts to learn more about the systems' budget.

A key element of the operation budget program is the tracking of costs in order to have accurate records each time the annual operating budget is developed. Having an annual baseline provides documentation for future budget considerations and provides justification for future rate increases. Collection system management should be aware of the procedures for calculating user rates and for recommending and making user rate changes.

Collection system and wastewater treatment plant costs may be combined into one budget, or budget line items may be divided into each of two individual budgets. For example, electrical and mechanical maintenance work performed by plant staff on a pump station may be carried as an O&M cost in the treatment plant budget, although pumping stations are generally considered to be a collection system component.

Examples of O&M Budget Items

- Labor (usually at least 50% of total budget)
- Utilities
- Capital
- Maintenance materials and supplies
- Chemicals
- Motor vehicles
- Contracted services

The cost of preventive and corrective maintenance and major collection system repairs and alterations are key items in the annual operating budget. The collection system owner or operator should keep adequate records of all maintenance costs, both in-house and contracted, plus the costs for spare parts. This will assist in the preparation of the following year's budget. In general, there should be an annual (12-month cycle) budget of discretionary and non-discretionary items. There may also be a Capital Improvement Plan (CIP) which may encompass small projects (one to two year cycles) or larger projects (three to five year cycles). Larger projects may include items such as equipment, labor, training, or root cause failure analysis.

The major categories of operating costs are labor, utilities, and supplies. Cost accounting for

these categories should include information on unit costs, total costs, and the amount and/or quantities used. The reviewer should evaluate the current and proposed budget, and current year balance sheets. In examining current and proposed expenditure levels, the reviewer should consider:

- Whether the budgets include contributions to capital reserve (sinking) funds. These funds are savings for replacement of system components once they reach their service life.
- Whether all income from water and sewer billings supports those functions, or if it goes into the general fund.
- Whether raising user fees is a feasible option to meet budget needs based on recent expenditure history.

2.2.2 Monitoring

The collection system owner or operator may be responsible for fulfilling some water quality or other monitoring requirements. Responsibilities may include:

- Monitoring discharges into the collection system from industrial users
- Monitoring to determine the effects of SSOs on receiving waters
- Monitoring required as part of an NPDES permit, a 308 letter, administrative order, or consent decree

The owner or operator should maintain written procedures to ensure that sampling is carried out in a safe, effective, and consistent manner. The procedures should specify, at a minimum the following:

- Sampling location(s)
- Sample volumes, preservatives, and holding times
- Instructions for the operation of any automatic sampling and/or field monitoring (e.g., pH or dissolved oxygen) equipment
- Sampling frequency
- Sampling and analytical methodologies
- Laboratory QA/QC

Records should be maintained of sampling events. These records should at a minimum include the following:

- Date, time, and location of sampling
- Sample parameters
- Date shipped or delivered to the laboratory

2.2.3 Hydrogen Sulfide Monitoring and Control

The collection system owner or operator should have a program under which they monitor areas of the collection system which may be vulnerable to the adverse effects of hydrogen sulfide. It may be possible to perform visual inspections of these areas. The records should note such items as the condition of metal components, the presence of exposed rebar (metal reinforcement in concrete), copper sulfate coating on copper pipes and electrical components, and loss of concrete from the pipe crown or walls.

Areas Subject to Generation of Hydrogen Sulfide:

- Sewers with low velocity conditions and/or long detention times
- Sewers subject to solids deposition
- Pump stations
- Turbulent areas, such as drop manholes or force main discharge points
- Inverted siphon discharges

As mentioned in Section 2.4.2, the collection system owner or operator should be carrying out routine manhole inspections. The hydrogen sulfide readings generated as a result of these inspections should be added to the records of potential areas of corrosion. A quick check of the pH of the pipe crown or structure enables early indication of potential hydrogen sulfide corrosion. A pH of less than four indicates further investigation is warranted. "Coupons" may be installed in structures or pipelines believed to be potentially subject to corrosion. Coupons are small pieces of steel inserted into the area and measured periodically to determine whether corrosion is occurring.

Reviewer - Point to Note
The reviewer should be aware that a system in which infiltration and inflow (I/I) has successfully been reduced may actually face an increased risk of corrosion. The reviewer should pay particular attention to the hydrogen sulfide monitoring program in these systems.

The reduction of flow through the pipes allows room for hydrogen sulfide gases to rise into the airway portion of the sewer pipe and react with the bacteria and moisture on the pipe walls to form sulfuric acid. Sulfuric acid corrodes ferrous metals and concrete.

There are several methods to prevent or control hydrogen sulfide corrosion. The first is proper design. Design considerations are beyond the scope of this manual but may be found in the *Design Manual: Odor and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants* (EPA 1985). The level of dissolved sulfide in the wastewater may also be reduced by chemical or physical means such as aeration, or the addition of chlorine, hydrogen peroxide, potassium permanganate, iron salts, or sodium hydroxide. Whenever chemical control agents are used, the owner or operator should have procedures for their application and maintain records of the dosages of the various chemicals. Alternatively, sewer cleaning to remove deposited solids reduces hydrogen sulfide generation. Also, air relief valves may be installed at the high points of the force main system. The valve allows air to exit thus avoiding air space at the crown of the pipe where acid can form. The reviewer should examine the records to see that these valves are

receiving periodic maintenance.

Collection systems vary widely in their vulnerability to hydrogen sulfide corrosion. Vitrified clay and plastic pipes are very resistant to hydrogen sulfide corrosion while concrete, steel, and iron pipes are more susceptible. The physical aspects of the collection system are also important. Sewage in pipes on a decline that moves the wastewater at a higher velocity will have less hydrogen sulfide than sewage in pipes where the wastewater may experience longer detention times. Therefore, some systems may need a more comprehensive corrosion control program while some might limit observations to vulnerable points.

2.2.4 Safety

The reasons for development of a safety program should be obvious for any collection system owner or operator. The purpose of the program is to define the principles under which the work is to be accomplished, to make the employees aware of safe working procedures, and to establish and enforce specific regulations and procedures. The program should be in writing (e.g., procedures, policies, and training courses) and training should be well documented.

Point to Note
Although a safety program may not be explicitly required under current NPDES regulations, an excessive injury rate among personnel increases the likelihood of collection system noncompliance with other requirements. Furthermore, when good safety practices are not followed, there may be a risk to the public or to collection system workers.

The purpose of safety training is to stress the importance of safety to employees. Safety training can be accomplished through the use of manuals, meetings, posters, and a safety suggestion program. One of the most common reasons for injury and fatalities in wastewater collection systems is the failure of victims to recognize hazards. Safety training cuts across all job descriptions and should emphasize the need to recognize and address hazardous situations. Safety programs should be in place for the following areas:

- Confined spaces
- Chemical handling
- Trenching and excavations
- Material Safety Data Sheets (MSDS)
- Biological hazards in wastewater
- Traffic control and work site safety
- Lockout/Tagout
- Electrical and mechanical safety
- Pneumatic or hydraulic systems safety

The collection system owner or operator should have written procedures which address all of the

above issues and are made available to employees. In addition to training, safety programs should incorporate procedures to enforce the program. For example, this could include periodic tests or "pop" quizzes to monitor performance and/or compliance and follow-up on safety related incidents.

Reviewer - Point to Note
The reviewer should, in the course of interviewing personnel, determine their familiarity with health and safety procedures according to their job description.

The owner or operator should maintain all of the safety equipment necessary for system staff to perform their daily activities and also undertake any emergency repairs. This equipment should include, at minimum:

- Atmospheric gas testing equipment
- Respirators and/or self-contained breathing apparatus
- Full body harness
- Tripods or non-entry rescue equipment
- Hard hats
- Safety glasses
- Rubber boots
- Rubber and/or disposable gloves
- Antibacterial soap
- First aid kit
- Protective clothing
- Confined space ventilation equipment
- Traffic and/or public access control equipment
- Hazardous gas meter

Each field crew vehicle should have adequate health and safety supplies. If the reviewer has access to the municipal vehicle storage area, he or she might choose to check actual vehicle stocks, not just supplies in storage.

2.2.5 Emergency Preparedness and Response

The collection system owner or operator should have a comprehensive plan in place for dealing with both routine and catastrophic emergencies. Routine emergencies include situations such as overflowing manholes, line breaks, localized electrical failure, and power outages at pump stations. Catastrophic emergencies include floods, tornados, earthquakes, other natural events, serious chemical spills, or widespread electrical

SSOs can include overflows out of manholes onto city streets, sidewalks, and surrounding areas (photo: U.S. EPA).

failure. Ideally, this plan is written, reviewed, and adjusted as needed at periodic intervals.

The reviewer should determine if the emergency response plan generally follows the guidelines described below. The location where the plan is housed may vary but, in general, such a document should be available in the yard office or other building commonly accessible to and frequented by collection system personnel. The emergency preparedness and response procedures may be contained in the collection system's O&M manual, or may be reflected in the descriptions of equipment and unit operations. Putting emergency procedures in a stand-alone document, rather than combining it with other information in the O&M manual, makes it easier for collection system personnel to find information.

The plan should utilize the most current information on the collection system. For larger systems, a structured analysis, or *risk assessment*, should be made of the collection system, treatment plant, and the community. The risk assessment should identify areas where the collection system is vulnerable to failure and determine the effect and relative severity to collection systems operations, equipment and public safety, and health of such a failure. The risk assessment should concentrate on such factors as topography, weather, sewer system size, and other site-specific factors which reflect the unique characteristics of the system. Once the areas of vulnerability are known, the collection system owner or operator should have appropriate plans in place to ensure collection system operations continue for the duration of the emergency.

The plans must clearly identify the steps staff should take in the event of emergency situations. Plans should include information on when it is appropriate to initiate and cease emergency operations. The plans should be very specific as to the collection system or repair equipment involved. Instructions should be available which explain how to operate equipment or systems during an emergency event when they are not functioning as intended but are not fully inoperable. The plan should also include specific procedures for reporting events that result in an overflow or other noncompliance event to the appropriate authorities.

The owner or operator should track emergency situations to become better prepared for future emergencies and to assist with reporting and maintaining compliance with emergency-related requirements. Typical components of an emergency program may include:

- General information regarding emergencies, such as telephone numbers of collection system personnel, fire department, and ambulance.
- Identification of hazards (e.g., chlorine storage areas) and use of universal classification system for hazards: combustible material, flammable liquids, energized electrical circuits, and hazardous materials.
- Vulnerability analysis that identifies the various types of emergencies that could occur, such as natural disasters, power outages, or equipment failures.
- Emergency response procedures.
- Methods to reduce risk of emergencies.
- Responsibilities of staff and management.

- Continuous training.

Procedures for emergency response plans should be understood and practiced by all personnel in order to ensure safety of the public and the collection system personnel responding. Procedures should be specific to the type of emergency that could occur. It is important to keep detailed records of all past emergencies in order to constantly improve response training, as well as the method and timing of future responses. The ability to deal with emergencies depends on the knowledge and skill of the responding crews, in addition to availability of equipment. The crew should be able to rapidly diagnose problems in the field under stress and select the right equipment needed to correct the problem. If resources are limited, consideration should be given to contracting other departments or private industries to respond to some emergency situations, for example, those rare emergencies that would exceed the capacity of staff.

2.2.6 Modeling

Computer programs (modeling programs) are available that are capable of simulating the different flows within the collection system. The purpose of modeling is to determine system capacity requirements with respect to sewer design and structural conditions. Therefore the input of accurate data on sizes, location, elevation, and condition of sewer system components such as pipes, manholes, and pump stations is necessary. When possible, flow monitoring data should be used to calibrate the model.

Reviewer - Point to Note
The reviewer should determine whether a model used by the owner or operator:

- Has user support
- Has adequate documentation such as a user's manual that describes data input requirements, output to be expected, model capabilities and limitations, and hardware

Modeling is also useful in examining effects before and after rehabilitation. For example, models can be applied to "before" and "after" scenarios to estimate the effects of repairs. If a collection system is not experiencing any capacity related issues (i.e., overflows, bypasses, basement backups, street flooding, hydraulic overload at the treatment plant, etc.) then maintenance of a model may be optional for that system, although most medium and large systems should maintain a model of the larger diameter portion of their system. If any of the mentioned conditions are occurring then development and maintenance of a model is essential to performing a capacity assessment in the problem areas.

Computer modeling is a specialized and complex subject. The reviewer may not have a comprehensive knowledge of modeling. If this is the case the he or she should obtain the following basic information:

- Is the owner or operator using a model?
- What areas of the collection system are being modeled and why?
- What model (including the version) is being used? Who developed the model and when?

- How are the modeling results being used?

2.2.7 Mapping

The importance of maintaining accurate, current maps of the collection system cannot be overstated. Efficient collection system maintenance and repairs are unlikely if mapping is not adequate. Collection system maps should clearly indicate the information that personnel need to carry out their assignments. The collection system maps should contain information on the following:

- Main, trunk and interceptor sewers
- Building/house laterals
- Manholes
- Cleanouts
- Force mains
- Pump stations
- Service area boundaries
- Other landmarks (roads, water bodies, etc.)

Collection system maps should have a numbering system which uniquely identifies all manholes and sewer cleanouts. The system should be simple and easy to understand. Manholes and sewer cleanouts should have permanently assigned numbers and never be renumbered. Maps should also indicate the property served and reference its cleanout.

Sewer line maps should indicate the diameter, the length between the centers of manholes, and the slope or direction of flow. The dimensions of easements and property lines should be included on the maps. Other information that should be included on maps are access and overflow points, a scale, and a north arrow. All maps should have the date the map was drafted and the date of the last revision. Although optional, maps often include materials of pipe construction. Maps may come in different sizes and scales to be used for different purposes. Detailed local maps may be used by maintenance or repair crews to perform the duties. However, these detailed local maps should be keyed to one overall map that shows the entire system.

Key Design Characteristics

- Line locations, grades, depths, and capacities
- Maximum manhole spacing and size
- Minimum pipe size
- Pumping Station dimensions and capacities
- Drop manholes
- Flow velocities and calculations (peak flow and low-flow)
- Accessibility features
- Other technical specifications (e.g., materials, equipment)

Geographic Information System (GIS) technology have made the mapping and map updating process considerably more efficient. GIS is a computerized mapping program capable of combining mapping with detailed information about the physical

structures within the collection system. If a GIS program is being used by the owner or operator, the reviewer should ask if the program is capable of accepting information from the owner or operator's management program.

Specific procedures should be established for correction of errors and updating maps and drawings. Field personnel should be properly trained to recognize discrepancies between field conditions and map data and record changes necessary to correct the existing mapping system. Reviewers should check to see that maps and plans are available to the personnel in the office and to field personnel or contractors involved in all engineering endeavors.

2.2.8 New Construction

The owner or operator should maintain strict control over the introduction of flows into the system from new construction. New construction may be public (i.e., an expansion of the collection system) or private (i.e., a developer constructing sewers for a new development). Quality sanitary sewer designs keep costs and problems associated with operations, maintenance, and construction to a minimum. Design flaws are difficult to correct once construction is complete. The reviewer should be aware that this has historically not been adequately addressed in some collection systems. The owner or operator should have standards for new construction, procedures for reviewing designs and protocols for inspection, start-up, testing, and approval of new construction. The procedures should provide documentation of all activities, especially inspection. Reviewers should examine construction inspection records and be able to answer the following:

- Does the volume of records seem reasonable given system size?
- Do records reflect that the public works inspectors are complying with procedures?

The state or other regulatory authority may also maintain standards for new construction. The standards held by the owner or operator should be at least as stringent. Start-up and testing should be in accordance with the manufacturers' recommendation where applicable and with recognized industry practices. Each step of the review, start-up, testing, and approval procedures should be documented.

The owner or operator approval procedure should reflect future ease of maintenance concerns. After construction is complete, a procedure for construction testing and inspection should be used. Construction supervision should be provided by qualified personnel such as a registered professional engineer.

2.2.9 Pump Stations

Proper operation, maintenance, and repair of pump stations typically requires special electrical, hydraulic, and mechanical knowledge. Pump station failure may damage equipment, the environment, or endanger public health. Variation in equipment types, pump station

configuration, and geographical factors determine pump station design and O&M requirements.

The reviewer should verify that the O&M manual contains procedures in writing for the following:

- Are pumps rotated manually or automatically? If manually, how frequently?
- Are wet well operating levels set to limit pump starts and stops?
- Is there a procedure for manipulating pump operations (manually or automatically) during wet weather to increase in-line storage of wet weather flows?
- Is flow monitoring provided? How is the data collected used?
- Does the pump station have capacity-related overflows? Maintenance related overflows? Is overflow monitoring provided?
- Is there a history of power outages? Is there a source of emergency power? If the emergency power source is a generator, is it regularly exercised under load?

2.3 Equipment and Collection System Maintenance

Every collection system owner or operator should have a well-planned, systematic, and comprehensive maintenance program. The goals of a maintenance program should include:

- Prevention of overflows
- Maximization of service and system reliability at minimum cost
- Assurance of infrastructure sustainability (i.e., ensure all components reach their service life)

There should then be procedures which describe the maintenance approach for various systems. In addition, there should be detailed instructions for the maintenance and repair of individual facilities. These instructions should provide a level of detail such that any qualified collection system personnel or repair technician could perform the repair or maintenance activity.

Maintenance may be planned or unplanned. There are essentially two types of planned maintenance; predictive and preventive. Predictive maintenance is a method that tries to look for early warning signs of equipment failure such that emergency maintenance is avoided. Preventive maintenance consists of scheduled maintenance activities performed on a regular basis. There are two types of unplanned maintenance, corrective and emergency. Corrective maintenance consists of scheduled repairs to problems identified under planned or predictive maintenance. Emergency maintenance are activities (typically repairs) performed in response to a serious equipment or line failure where action must be taken immediately. The goal of every owner or operator should be to reduce corrective and emergency maintenance through the use of planned and predictive maintenance. The reviewer should evaluate the progress of the owner or operator in achieving that goal. The goals of the reviewer in assessment of the maintenance program are:

- Identify SSOs caused by inadequate maintenance
- Determine maintenance trends (i.e., frequent emergency maintenance performed as opposed to predictive maintenance)
- Identify sustainability issues (i.e., inadequate maintenance to allow system components to reach service life and/or many components nearing or at service life)

2.3.1 Maintenance Budgeting

The cost of a maintenance program is a significant part of the annual operating budget. The collection system owner or operator should track all maintenance costs incurred throughout the year, both by internal staff and contractors, to ensure that the budget is based on representative costs from past years. Budgets should be developed from past cost records which usually are categorized according to preventive maintenance, corrective maintenance, and projected and actual major repair requirements. Annual costs should be compared to the budget periodically to control maintenance expenditures.

The reviewer should evaluate the maintenance budget keeping in mind the system's characteristics, such as age. Costs for emergency repairs should be a relatively small percentage of the budget; five to ten percent would not be considered excessive. The establishment of an "emergency reserve" may also be included as part of the maintenance budget. This is especially useful where full replacement is not funded. The budget should also be considered in light of maintenance work order backlog. The labor budget should be evaluated for consistency with local pay rates and staffing needs and the reviewer should compare local pay rates and staffing needs according to the tables in Section 2.1.1.

2.3.2 Planned and Unplanned Maintenance

A planned maintenance program is a systematic approach to performing maintenance activities so that equipment failure is avoided. Planned maintenance is composed of predictive and preventive maintenance. In the end, a good planned maintenance program should reduce material and capital repair and replacement costs, improve personnel utilization and morale, reduce SSOs, and sustain public confidence.

Examples of predictive maintenance includes monitoring equipment for early warning signs of impending failure, such as excess vibration, heat, dirty oil, and leakage. Assessment and inspection activities can be classified as predictive maintenance. Vibration and lubrication analyses, thermography, and ultrasonics are among the more common predictive maintenance tools. Predictive maintenance also takes into account historical information about the system as all systems will deteriorate over time. A predictive maintenance program strives to identify potential problem areas and

Reviewer - Point to Note
The reviewer should inquire as to whether tools such as vibration and lubrication analysis, thermography, or ultrasonics are used, and obtain information on the extent of the programs.

uncover trends that could affect equipment performance. Predictive maintenance offers an early warning. It allows collection system personnel to detect early signs of increasing rates of wear and therefore failure, and thus shift a "corrective" task into a "planned" task. To be truly effective predictive, however, maintenance should not spur personnel into doing the work too soon and wasting useful life and value of the equipment in question.

The basis of a good predictive maintenance program is recordkeeping. Only with accurate recordkeeping can baseline conditions be established, problem areas identified, and a proactive approach taken to repairs and replacement.

Effective preventive maintenance minimizes system costs and environmental impacts by reducing breakdowns and thus the need for corrective or emergency maintenance, improves reliability by minimizing the time equipment is out of service, increases the useful life of equipment thus avoiding costly premature replacement, and avoids potential noncompliance situations. An effective preventive maintenance program includes:

- Trained personnel
- Scheduling based on system specific knowledge
- Detailed instructions related to the maintenance of various pieces of equipment
- A system for recordkeeping
- System knowledge in the form of maps, historical knowledge and records

An effective preventive maintenance program builds on the inspection activities and predictive maintenance described in Sections 2.4.1 to 2.4.4, and includes a well thought-out schedule for these activities.

Lubrication

Lubrication is probably one of the most important maintenance activities for mechanical systems, such as pumps and motors. Frequency of lubrication, choice of lubricant and lubrication procedure are all important factors in this activity. These items should closely follow manufacturer instructions, but may be modified to fit site-specific conditions and particular equipment applications.

The basis of the schedule for mechanical equipment maintenance (i.e., pump station components) should be the manufacturers' recommended activities and frequencies. This schedule may then be augmented by the knowledge and experience of collection system personnel to reflect the site-specific requirements. The schedule for sewer line cleaning, inspection, root removal, and repair activities should be based on periodic inspection data. In most systems, uniform frequencies for sewer line cleaning, inspection, and root removal are not necessary and inefficient. In many systems, a relatively small percentage of the pipe generates most of the problems. Efficient use of inspection data allows the owner or operator to implement a schedule in the most constructive manner. In rare cases it may be appropriate to reduce maintenance frequency for a particular piece of equipment. An example of a scheduling code and maintenance schedule for a pump is shown below:

Rotary Pump Maintenance Schedule	
Frequency	**Maintenance Required**
D	Check packing gland assembly
D	Check discharge pressure
S	Inspect and lubricate bearings
A	Flush bearings and replace lubricant

D = Daily A = Annually
S = Semiannually

Typically, there is a maintenance card or record for each piece of equipment within the collection system. These records should contain maintenance recommendations, schedule, and instructions on conducting the specific maintenance activity. The records should include documentation regarding any maintenance activities conducted to date and other observations related to that piece of equipment or system. Maintenance records are generally kept where maintenance personnel have easy access to them. The reviewer should examine the full series of periodic work orders (i.e. weekly, monthly, semiannually, and annually) for a selection of system components (e.g., a few pump stations, several line segments). The reviewer should then compare the recommended maintenance frequency to that which is actually performed. He or she should also look at the backlog of work; not focusing solely on the number of backlogged work orders, but on what that number represents in time. A very large system can have a hundred orders backlogged and only be one week behind. In a computerized system, a listing of all open work orders is usually very simple for collection system personnel to generate. The owner or operator should be able to explain their system for prioritizing work orders.

The reviewer needs to clearly understand the following:

- How the maintenance data management system works
- How work orders are generated and distributed
- How field crews use the work orders
- How data from the field is collected and returned
- How and on whose authority work orders are closed out

The reviewer should check to see if data entry is timely and up to date.

Unplanned maintenance is that which takes place in response to equipment breakdowns or emergencies. Unplanned maintenance may be corrective or emergency maintenance. Corrective maintenance could occur as a result of preventive or predictive maintenance activities which identified a problem situation. A work order should be issued so that the request for corrective maintenance is directed to the proper personnel. An example of non-emergency corrective maintenance could be a broken belt on a belt driven pump. The worn belt was not detected and

replaced through preventive maintenance and therefore the pump is out of service until corrective maintenance can be performed. Although the pump station may function with one pump out of service, should another pump fail, the situation may become critical during peak flow periods.

If the information can be easily generated the reviewer should select a sampling of work orders and compare them to the corrective maintenance database to determine if repairs are being made in a timely manner. Reviewers should note the current backlog of corrective maintenance work orders. A corrective maintenance backlog of two weeks or less would indicate an owner or operator in control of corrective maintenance. The owner or operator should be able to explain corrective maintenance work orders that have not been completed within six months.

Corrective maintenance takes resources away from predictive and preventive maintenance. When corrective maintenance becomes a predominant activity, personnel may not be able to perform planned maintenance, thus leading to more corrective maintenance and emergency situations. Emergency maintenance occurs when a piece of equipment or system fails, creating a threat to public health, the environment, or associated equipment. This type of maintenance involves repairs, on short notice, of malfunctioning equipment or sewers. A broken force main, totally non-functional pump station, and street cave-ins are all examples of emergency situations.

Types of Portable Emergency Equipment

- Bypass pumps
- Portable generator
- Air compressor, trailer-mounted
- Manhole lifters and gas testing equipment
- Sewer rodder and/or flushing machine
- Portable lights and hand tools
- Chemical spray units (for insects and rodent control)
- Truck (1-ton) and trailers
- Vacuum truck
- Repair equipment for excavation (backhoe, shoring equipment, concrete mixers, gasoline operated saws, traffic control equipment, etc.)
- Confined space entry gear

Emergency crews should be geared to a 24-hour-a-day, year-round operation. Most large systems have staffed 24-hour crews; many small systems have an "on-call" system. The owner or operator should be able to produce written procedures which spell out the type of action to take in a particular type of emergency and the equipment and personnel requirements necessary to carry out the action. The crews should have copies of these procedures and be familiar with them. Equipment must be located in an easily accessible area and be ready to move in a short period of time. Vehicles and equipment must be ready to perform, under extreme climatic conditions if necessary. The emergency crew

Reviewer - Point to Note
The reviewer should note the presence of supplies during the review of the yard where equipment and spare parts are maintained and personnel are dispatched.

may need materials such as piping, pipe fittings, bedding materials and concrete. The owner or operator should have supplies on hand to allow for two point (i.e. segment, fitting, or appurtenance) repairs of any part of its system.

Pump stations should be subject to inspection and preventive maintenance on a regular schedule. The frequency of inspection may vary from once a week, for a reliable pump station equipped with a telemetry system, to continuous staffing at a large pump station. The basic inspection should include verification that alarm systems are operating properly, wet well levels are properly set, all indicator lights and voltage readings are within acceptable limits, suction and discharge pressures are within normal limits, that the pumps are running without excessive heat or vibration and have the required amount of lubrication, and that the emergency generator is ready if needed. Less frequent inspections may include such items as vibration analysis and internal inspection of pump components.

Owner or Operator - Point to Note
Occasionally a supervisor should perform an unscheduled inspection to confirm that tasks have been performed as expected.

Observations and tasks performed should be recorded in a log book or on a checklist at the pump station. It is important to note how this data returns to the central maintenance data management system. At the time of the inspection, collection system personnel may perform minor repairs if necessary. If non-emergency repairs are required that are beyond the staff's training, it will probably be necessary to prepare a work order which routs a request though the proper channels to initiate the repair action. During the review the reviewer should check a random number of work orders to see how they move through the system. The reviewer should note whether repairs are being carried out promptly. In pump stations, for critical equipment (pumps, drives, power equipment, and control equipment), there should not be much backlog, unless the staff is waiting for parts.

During the review, the reviewer should also make on-site observations of a representative pump stations. The reviewer should plan at least half an hour to look at the simplest two-pump prefabricated station, and one to two hours to look at a larger station. In large systems, drive time between stations may be significant. The reviewer should strive to see a range of pump station sizes and types (i.e., the largest, smallest, most remote and any that review of work orders has indicated might be problematic).

Overall, the pump station should be clean, in good structural condition and exhibit minimal odor. The reviewer should note the settings of the pumps (i.e., which are operating, which are on stand-by, and which are not operating and why). The operating pumps should be observed for noise, heat, and excessive vibration. The settings in the wet well should be noted (as indicated on the controls, as direct observation of the reviewer in the wet well is not recommended) and the presence of any flashing alarm lights. The reviewer is reminded of the atmospheric hazards in a pump station (make sure ventilation has been running prior to arrival) and to avoid confined

space entry. If the pump station has an overflow its outlet should be observed, if possible, for signs of any recent overflows such as floatable materials or toilet paper. The reviewer should check the log book and/or checklist kept at the pump station to ensure that records are current and all maintenance activities have been performed. Below is a listing of items that indicate inadequate maintenance:

- Overall poor housekeeping and cleanliness
- Excessive grease accumulation in wet well
- Excessive corrosion on railings, ladders, and other metal components
- Sagging, worn, improperly sized, or inadequate belts
- Excessive equipment out of service for repair or any equipment for which repair has not been ordered (i.e., a work order issued)
- Pumps running with excessive heat, vibration, or noise
- Peeling paint and/or dirty equipment (the care given to equipment's outer surfaces often, but not always, mirrors internal condition)
- Check valves not closing when pumps shut off
- Inoperative instrumentation, alarms, and recording equipment
- "Jury-rigged" repairs (i.e., "temporary" repairs using inappropriate materials)
- Leakage from pumps, piping, or valves (some types of pump seals are designed to "leak" seal water)
- Inadequate lighting or ineffective/inoperative ventilation equipment

2.3.3 Sewer Cleaning

The purpose of sewer cleaning is to remove accumulated material from the sewer. Cleaning helps to prevent blockages and is also used to prepare the sewer for inspections. Stoppages in gravity sewers are usually caused by a structural defect, poor design, poor construction, an accumulation of material in the pipe (especially grease), or root intrusion. Protruding traps (lateral sewer connections incorrectly installed so that they protrude into the main sewer) may catch debris which then causes a further buildup of solids that eventually block the sewer. If the flow is less than approximately 1.0 to 1.4 feet per second, grit and solids can accumulate leading to a potential blockage.

Results of Various Flow Velocities

Velocity	Result
2.0 ft/sec	Very little material buildup in pipe
1.4-2.0 ft/sec	Heavier grit (sand and gravel) begin to accumulate
1.0-1.4 ft/sec	Inorganic grit and solids accumulate
Below 1.0 ft/sec	Significant amounts of organic and inorganic solids accumulate

(EPA 1974)

There are three major methods of sewer cleaning: hydraulic, mechanical, and chemical.

Hydraulic cleaning (also referred to as flushing) refers to any application of water to clean the pipe. Mechanical cleaning uses physical devices to scrape, cut, or pull material from the sewer. Chemical cleaning can facilitate the control of odors, grease buildup, root growth, corrosion, and insect and rodent infestation. For additional information on sewer cleaning methods refer to Volumes I and II of *Operation and Maintenance of Wastewater Collection Systems* (CSU Sacramento 1996 and 1998).

Sewer Cleaning Records

- Date, time, and location of stoppage or routine cleaning activity
- Method of cleaning used
- Cause of stoppage
- Identity of cleaning crew
- Further actions necessary and/or initiated
- Weather conditions

The backbone of an effective sewer cleaning program is accurate recordkeeping. Accurate recordkeeping provides the collection system owner or operator with information on the areas of the collection system susceptible to stoppages such that all portions of the system can be on an appropriate schedule. The reviewer should examine the records for legibility and completeness. He or she should then review the database to determine if entry of the field notes is current and accurate.

Root and grease buildup can cause blockages in a sewer system [photo: North Carolina Department of Natural Research (NCDNR)].

Sewers vary widely in their need for preventive cleaning. The collection system in a restaurant district may require cleaning every six months in order to prevent grease blockages. An area of the sewer system with new PVC piping and no significant grease contribution with reasonable and consistent slopes (i.e., no sags) may be able to go five years with no problems.

The owner or operator should be able to identify problem collection system areas, preferably on a map. Potential problem areas identified should include those due to grease or industrial discharges, hydraulic bottlenecks in the collection system, areas of poor design (e.g., insufficiently sloped sewers), areas prone to root intrusion, sags, and displacements. The connection between problem areas in the collection system and the preventive maintenance cleaning schedule should be clear. The owner or operator should also be able to identify the number of stoppages experienced per mile of sewer pipe. If the system is experiencing a steady increase in stoppages, the reviewer should try to determine the cause (i.e., lack of preventive maintenance funding, deterioration of the sewers due to age, an increase in grease producing activities, etc).

2.3.4 Parts and Equipment Inventory

An inventory of spare parts, equipment, and supplies should be maintained by the collection system owner or operator. The inventory should be based on equipment manufacturer's recommendations, supplemented by historical experience with maintenance and equipment problems. Without such an inventory, the collection system may experience long down times or periods of inefficient operation in the event of a breakdown or malfunction.

Basic Equipment Inventory

- Type, age, and description of the equipment
- Manufacturer
- Fuel type and other special requirements
- Operating costs and repair history

Files should be maintained on all pieces of equipment and major tools. The owner or operator should have a system to assure that each crew always has adequate tools. Tools should be subject to sign out procedures to provide accountability. Tools and equipment should be replaced at the end of their useful life. The reviewer should inquire as to how this is determined and how funds are made available to ensure this is the case. In addition, the reviewer should look at the tools and note their condition.

The owner or operator should maintain a yard where equipment, supplies, and spare parts are maintained and personnel are dispatched. Very large systems may maintain more than one yard. In this case, the reviewer should perform a visual survey at the main yard. In small to medium size systems, collection system operations may share the yard with the department of public works, water department, or other municipal agencies. In this case the reviewer should determine what percentage is being allotted for collection system items. The most important features of the yard are convenience and accessibility.

The reviewer should observe a random sampling of inspection and maintenance crew vehicles for equipment as described above. A review of the equipment and manufacturer's manuals aids in determining what spare parts should be maintained. The owner or operator should then consider the frequency of usage of the part, how critical the part is, and finally how difficult the part is to obtain when determining how many of the part to keep in stock. Spare parts should be kept in a clean, well-protected stock room. Critical parts are those which are essential to the operation of the collection system. Similar to equipment and tools management, a tracking system should be in place, including procedures on logging out materials, when maintenance personnel must use them. The owner or operator should be able to produce the spare parts inventory and clearly identify those parts deemed critical. The reviewer should evaluate the inventory and selected items in the stockroom to determine whether the specified number of these parts are being maintained.

Owner or Operator - Point to Note
The owner or operator should have a procedure for determining which spare parts are critical.

2.4 Sewer System Capacity Evaluation - Testing and Inspection

The collection system owner or operator should have a program in place to periodically evaluate the capacity of the sewer system in both wet and dry weather flows and ensure the capacity is maintained as it was designed. The capacity evaluation program builds upon ongoing activities and the everyday preventive maintenance that takes place in a system. The capacity evaluation begins with an inventory and characterization of the system components. The inventory should include the following basic information about the system:

- Population served
- Total system size (feet or miles)
- Inventory of pipe length, size, material and age, and interior and exterior condition as available
- Inventory of appurtenances such as bypasses, siphons, diversions, pump stations, tide or flood gates and manholes, etc., including size or capacity, material and age, and condition as available
- Force main locations, length, size and materials, and condition as available
- Pipe slopes and inverts
- Location of house laterals - both upper and lower

The system then undergoes general inspection (described below in Sections 2.4.1 to 2.4.4) which serves to continuously update and add to the inventory information.

The next step in the capacity evaluation is to identify the location of wet weather related SSOs, surcharged lines, basement backups, and any other areas of known capacity limitations. These areas warrant further investigation in the form of flow and rainfall monitoring and inspection procedures to identify and quantify the problem. The reviewer should determine that the capacity evaluation includes an estimate peak flows experienced in the system, an estimate of the capacity of key system components, and identifies the major sources of I/I that contribute to hydraulic overloading events. The capacity evaluation should also make use of a hydraulic model, if any, to identify areas with hydraulic limitations and evaluate alternatives to alleviate capacity limitations. Short and long term alternatives to address hydraulic deficiencies should be identified, prioritized, and scheduled for implementation.

A sewer inspection is an important part of a sewer system capacity evaluation (photo: N.J. Department of Environmental Protection).

2.4.1 Flow Monitoring

Fundamental information about the collection system is obtained by flow monitoring. Flow monitoring provides information on dry weather flows as well as areas of the collection system potentially affected by I/I. Flow measurement may also be performed for billing purposes, to assess the need for new sewers in a certain area, or to calibrate a model. There are three techniques commonly used for monitoring flow rates: (1) permanent and long-term, (2) temporary, and (3) instantaneous. Permanent installations are done at key points in the collection system such as the discharge point of a satellite collection system, pump stations, and key junctions. Temporary monitoring consists of flow meters typically installed for 30-90 days. Instantaneous flow metering is performed by collection system personnel, one reading is taken and then the measuring device is removed. The collection system owner or operator should have a flow monitoring plan that describes their flow monitoring strategy or should at least be able to provide the following information:

- Purpose of the flow monitoring
- Location of all flow meters
- Type of flow meters
- Flow meter inspection and calibration frequency

A flow monitoring plan should provide for routine inspection, service, and calibration checks (as opposed to actual calibration). In some cases, the data is calibrated rather than the flow meter. Checks should include taking independent water level (and ideally velocity readings), cleaning accumulated debris and silt from the flow meter area, downloading data (sometimes only once per month), and checking the desiccant and battery state. Records of each inspection should be maintained.

Flow measurements performed for the purpose of quantifying I/I are typically separated into three components: base flow, infiltration, and inflow. Base flow is generally taken to mean the wastewater generated without any I/I component. Infiltration is the seepage of groundwater into pipes or manholes through defects such as cracks, broken joints, etc. Inflow is the water which enters the sewer through direct connections such as roof leaders, direct connections from storm drains or yard, area, and foundation drains, the holes in and around the rim of manhole covers, etc. Many collection system owners or operators add a third classification: rainfall induced infiltration (RII). RII is stormwater that enters the collection system through defects that lie so close to the ground surface that they are easily reached. Although not from piped sources, RII tends to act more like inflow than infiltration.

In addition to the use of flow meters, which may be expensive for a small owner or operator, other methods of inspecting flows may be employed such as visually monitoring manholes during low-flow periods to determine areas with excessive I/I. For a very small system, this technique may be an effective and low-cost means of identifying problem areas in the system which require further investigation.

The owner or operator should have in place a program for the efficient identification of excessive I/I. The program should look at the wastewater treatment plant, pump stations, permanent meter flows, and rainfall data to characterize peaking factors for the whole system and major drainage basins. The reviewer should evaluate the program including procedures and records associated with the flow monitoring plan. Temporary meters should be used on a "roving" basis to identify areas with high wet weather flows. Areas with high wet weather flows should then be subject to inspection and rehabilitation activities.

2.4.2 Sewer System Testing

Sewer system testing techniques are often used to identify leaks which allow unwanted infiltration into the sewer system and determine the location of illicit connections and other sources of stormwater inflow. Two commonly implemented techniques include smoke testing and dyed water testing. Regardless of the program(s) implemented by the owner or operator, the reviewer should evaluate any procedures and records that have been established for these programs. The reviewer should also evaluate any public relations program and assess how the owner or operator communicates with the public during these tests (i.e., when there is a possibility of smoke entering a home or building).

Smoke testing is a relatively inexpensive and quick method of detecting sources of inflow in sewer systems, such as down spouts, or driveway and yard drains and works best suited for detecting cross connections and point source inflow leaks. Smoke testing is not typically used on a routine basis, but rather when evidence of excessive I/I already exists. With each end of the sewer of interest plugged, smoke is introduced into the test section, usually via a manhole. Sources of inflow can then be identified when smoke escapes through them.

Areas Usually Smoke Tested

- Drainage paths
- Ponding areas
- Roof leaders
- Cellars
- Yard and area drains
- Fountain drains
- Abandoned building sewers
- Faulty service connections

If the collection system owner or operator implements a regular program of smoke testing, the program should include a public notification procedure. The owner or operator should also have procedures to define:

- How line segments are isolated
- The maximum amount of line to be smoked at one time
- The weather conditions in which smoke testing is conducted (i.e., no rain or snow, little wind and daylight only)

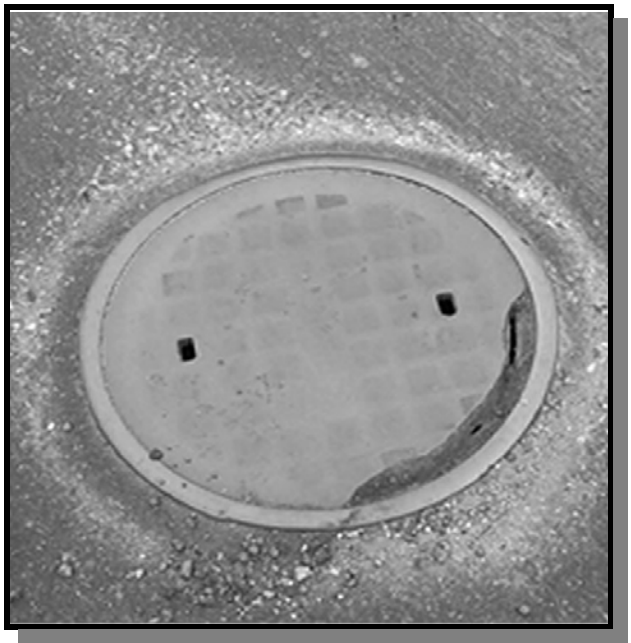
The results of positive smoke tests should be documented with carefully labeled photographs. Building inspections are sometimes conducted as part of a smoke testing program and, in some cases, may be the only way to find illegal connections. If properly connected to the sanitary sewer system, smoke should exit the vent stacks of the surrounding properties. If traces of the

smoke or its odor enter the building, it is an indication that gases from the sewer system may also be entering. Building inspections can be labor intensive and require advanced preparation and communication with the public.

Dyed water testing may be used to establish the connection of a fixture or appurtenance to the sewer. It is often used to confirm smoke testing or to test fixtures that did not smoke. As is the case with smoke testing, it is not used on a routine basis but rather in areas that have displayed high wet weather flows. Dyed water testing can be used to identify structurally damaged manholes that might create potential I/I problems. This is accomplished by flooding the area close to the suspected manholes with dyed water and checking for entry of dyed water at the frame-chimney area, cone/corbel, and walls of the manhole.

2.4.3 Sewer System Inspection

Visual inspection of manholes and pipelines are the first line of defense in the identification of existing or potential problem areas. Visual inspections should take place on both a scheduled basis and as part of any preventive or corrective maintenance activity. Visual inspections provide additional information concerning the accuracy of system mapping, the presence and degree of I/I problems, and the physical state-of-repair of the system. By observing the manhole directly and the incoming and outgoing lines with a mirror, it is possible to determine structural condition, the presence of roots, condition of joints, depth of debris in the line, and depth of flow. The reviewer should examine the records of visual inspections to ensure that the following information is recorded:



Damage to the sewer system infrastructure, such as this broken manhole cover allows stormwater into the sewer system (photo: Limno-Tech, Inc.)

- Manhole identification number and location
- Cracks or breaks in the manhole or pipe (inspection sheets and/or logs should record details on defects)
- Accumulations of grease, debris, or grit
- Wastewater flow characteristics (e.g., flowing freely or backed up)
- Inflow
- Infiltration (presence of clear water in or flowing through the manhole)
- Presence of corrosion
- Offsets or misalignments
- Condition of the frame
- Evidence of surcharge
- Atmospheric hazard measurements (especially hydrogen sulfide)
- If repair is necessary, a notation as to whether a work order has been issued

Manholes should undergo routine inspection typically every one to five years. There should be a baseline for manhole inspections (e.g., once every two years) with problematic manholes being inspected more frequently. The reviewer should conduct visual observation at a small but representative number of manholes for the items listed above.

There are various pipeline inspection techniques, the most common include: lamping, camera inspection, sonar, and CCTV. These will be explained further in the following sections.

2.4.3.1 Sewer System Inspection Techniques

Sewer inspection is an important component of any maintenance program. There are a number of inspection techniques that may be employed to inspect a sewer system. The reviewer should determine if a inspection program includes frequency and schedule of inspections and procedures to record the results. Sewer system cleaning should always be considered before inspection is performed in order to provide adequate clearance and inspection results. Additionally, a reviewer should evaluate records maintained for inspection activities including if information is maintained on standardized logs and should include:

- Location and identification of line being inspected
- Pipe size and type
- Name of personnel performing inspection
- Distance inspected
- Cleanliness of the line
- Condition of the manhole with pipe defects identified by footage from the starting manhole
- Results of inspection, including estimates of I/I

Lamping involves lowering a still camera into a manhole. The camera is lined up with the centerline of the junction of the manhole frame and sewer. A picture is the taken down the pipe with a strobe-like flash. A disadvantage of this technique is that only the first 10-12 feet of the pipe can be inspected upstream and downstream of the access point. Additionally, it has limited use in small diameter sewers. The benefits of this technique include not requiring confined space entry and little equipment and set-up time is required.

Camera inspection is more comprehensive then lamping in that more of the sewer can be viewed. A still camera is mounted on a floatable raft and released into a pipe. The camera takes pictures with a strobe-like flash as it floats through the sewer pipe. This technique is often employed in larger lines where access points are far apart. Similarly to lamping, portions of the pipe may still be missed using this technique. Obviously, there also must be flow in the pipe for the raft to float. This technique also does not fully capture the invert of the pipe and its condition.

Sonar is a newer technology deployed similarly to CCTV cameras, described in more detail below. The sonar emits a pulse which bounces off the walls of the sewer. The time it takes for

this pulse to bounce back provides data providing an image of the interior of the pipe including its structural condition. A benefit of this technique is that it can be used in flooded or inaccessible sections of the sewer. The drawback is that the technique requires heavy and expensive equipment.

Sewer scanner and evaluation is an experimental technology where a 360 degree scanner produces a full digital picture of the interior of the pipe. This technique is similar to sonar in that a more complete image of a pipe can be made than with CCTV, but not all types of sewer defects may be identified as readily (i.e., infiltration, corrosion).

Closed Circuit Television (CCTV) inspections are a helpful tool for early detection of potential problems. This technique involves a closed-circuit camera with a light which is self-propelled or pulled down the pipe. As it moves it records the interior of the pipe. CCTV inspections may be done on a routine basis as part of the preventive maintenance program as well as part of an investigation into the cause of I/I. CCTV, however, eliminates the hazards associated with confined space entry. The output is displayed on a monitor and videotaped. A benefit of CCTV inspection is that a permanent visual record is captured for subsequent reviews.

2.5 Sewer System Rehabilitation

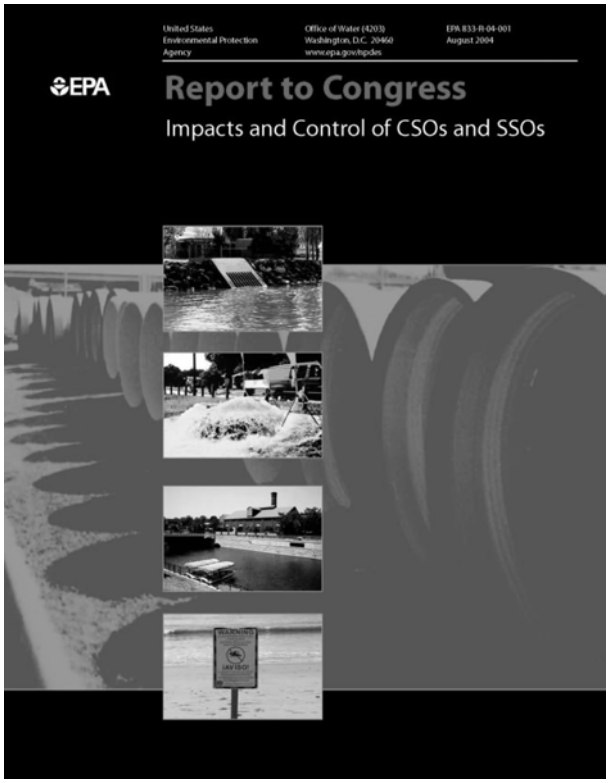
The collection system owner or operator should have a sewer rehabilitation program. The objective of sewer rehabilitation is to maintain the overall viability of a collection system. This is done in three ways: (1) ensuring its structural integrity; (2) limiting the loss of conveyance and wastewater treatment capacity due to excessive I/I; and (3) limiting the potential for groundwater contamination by controlling exfiltration from the pipe network. The rehabilitation program should build on information obtained as a result of all forms of maintenance and observations made as part of the capacity evaluation and asset inventory to assure the continued ability of the system to provide sales and service at the least cost. The reviewer should try to gain a sense of how rehabilitation is prioritorized. Priorities may be stated in the written program or may be determined through interviews with system personnel.

There are many rehabilitation methods. The choice of methods depends on pipe size, type, location, dimensional changes, sewer flow, material deposition, surface conditions, severity of I/I, and other physical factors. Non-structural repairs typically involve the sealing of leaking joints in otherwise sound pipe.

Structural repairs involve either the replacement of all or a portion of a sewer line, or the lining of the sewer. These repairs can be carried out by excavating usually for repairs limited to one or two pipe segments (these are known as point repairs) or by trenchless technologies (in which repair is carried out via existing manholes or a limited number of access excavations).

The rehabilitation program should identify the methods that have been used in the past, their success rating and methods to be used in the future. An reviewer who wants further guidance on methods of rehabilitation may consult:

- Technology Description from 2004 Report to Congress (EPA 2004)
- *Operation and Maintenance of Wastewater Collection Systems,* Volumes I and II (CSU Sacramento 1996 and 1998)
- *Existing Sewer Evaluation and Rehabilitation* (WEF 1994)



The reviewer should determine the owner's or operator's policies regarding service lateral rehabilitation since service laterals can constitute a serious source of I/I. Manholes should not be neglected in the rehabilitation program. Manhole covers can allow significant inflow to enter the system because they are often located in the path of surface runoff. Manholes themselves can also be a significant source of infiltration from cracks in the barrel of the manhole.

The owner or operator should be able to produce documentation on the location and methods used for sewer rehabilitation. The reviewer should compare the rehabilitation accomplished with that recommended by the capacity evaluation program. When examining the collection system rehabilitation program, the reviewer should be able to answer the following questions:

- Is rehabilitation taking place before it becomes emergency maintenance?
- Are recommendations made as a result of the previously described inspections?
- Does the rehabilitation program take into account the age and condition of the sewers?

CHAPTER 3. CHECKLIST FOR CONDUCTING EVALUATIONS OF WASTEWATER COLLECTION SYSTEM CAPACITY, MANAGEMENT, OPERATION, AND MAINTENANCE (CMOM) PROGRAMS

The following is a comprehensive checklist available for use in the review process. The checklist consists of a series of questions organized by major categories and sub-categories. The major category is followed by a brief statement describing the category. Following the sub-category is a brief clarifying statement. References are then given.

Questions are provided in a table format that includes the question, response, and documentation available.

Response is completed by using information and data acquired from the data and information request, onsite interviews, and site reviews. An alternative to this process is to transmit the entire checklist to the collection system owner or operator to complete and return electronically.

Table of Contents

I. General Information - Collection System Description 3-4
II. Continuing Sewer Assessment Plan 3-5
III. Collection System Management 3-6
A. Organizational Structure 3-6
B. Training 3-7
C. Communication and Customer Service 3-8
D. Management Information Systems 3-10
E. SSO Notification Program 3-11
F. Legal Authority 3-12
IV. Collection System Operation 3-14
A. Budgeting 3-14
B. Compliance 3-16
C. Water Quality Monitoring 3-17
D. Hydrogen Sulfide Monitoring and Control 3-18
E. Safety 3-19
F. Emergency Preparedness and Response 3-21
G. Modeling 3-23
H. Engineering - System Mapping and As-built Plans (Record Drawings) 3-24
I. Engineering - Design 3-25
J. Engineering - Capacity 3-26
K. Engineering - Construction 3-27
L. Pump Station Operation 3-28
1. Pump Stations - Inspection 3-29
2. Pump Stations - Emergencies 3-30
3. Pump Stations - Emergency Response and Monitoring 3-31
4. Pump Stations - Recordkeeping 3-32
5. Pump Stations - Force Mains and Air/Vacuum Valves 3-33
V. Collection System Maintenance 3-34
A. Maintenance Budgeting 3-34
B. Planned Maintenance 3-35
C. Maintenance Scheduling 3-36
D. Maintenance Right-of-Way 3-37
E. Sewer Cleaning 3-38
1. Sewer Cleaning - Cleaning Equipment 3-39
2. Sewer Cleaning - Chemical Cleaning and Root Removal 3-40
F. Parts Inventory 3-41
G. Equipment and Tools Management 3-42
VI. Management Information Systems: Performance Indicators 3-43
VII. Sewer System Capacity Evaluation (SSES) 3-45
A. Internal TV Inspection 3-45
B. Survey and Rehabilitation (general) 3-46
C. Sewer Cleaning Related to I/I Reduction 3-47
D. Flow Monitoring 3-48
E. Smoke Testing and Dyed Water Flooding 3-49

F. Manhole Inspection 3-50
VIII. Rehabilitation 3-52
A. Manhole Repairs 3-52
B. Mainline Sewers 3-53

I. General Information - Collection System Description

Question	Response	Documentation Available	
		Yes	No
Size of service area (acres).			
Population of service area.			
Number of pump stations.			
Feet (or miles) of sewer.			
Age of system (e.g., 30% over 30 years, 20% over 50 years, etc.).			

Comments:

II. Continuing Sewer Assessment Plan

Question	Response	Documentation Available	
		Yes	No
Does the collection system experience problems related to I/I? How do these problems manifest themselves? (Manhole overflows, basement flooding, structure, SSOs)			
How does the owner or operator prioritize investigation, repairs and rehabilitation related to I/I?			
What methods are considered to remedy hydraulic deficiencies?			
Does the plan include a schedule for investigative activities?			
Is the plan regularly updated?			

Comments:

III. A. Collection System Management: Organizational Structure

Question	Response	Documentation Available	
		Yes	No
Is an organizational chart available that shows the overall personnel structure for the collection system, including operation and maintenance staff?			
Are there organizational charts that show functional groups and classifications?			
Are up to date job descriptions available that delineate responsibilities and authority for each position?			
Are the following items discussed in the job descriptions: ☐ nature of work to be performed, ☐ minimum requirements for the position, ☐ necessary special qualifications or certifications, ☐ examples of the types of work, ☐ list of licences required for the position, ☐ performance measures or promotional potential?			
Does the organizational chart indicate how many positions are budgeted as opposed to actually filled?			
On average, how long do positions remain vacant?			
Are collection system staff responsible for any other duties, (e.g., road repair or maintenance, O&M of the storm water collection system)?			

Comments:

III. B. Collection System Management: Training

Question	Response	Documentation Available	
		Yes	No
Is there a documented formal training program?			
Does the training program address the fundamental mission, goals, and policies of the collection system owner or operator?			
Does the owner or operator provide training in the following areas: ☐ safety, ☐ routine line maintenance, ☐ confined space entry, ☐ traffic control, ☐ record keeping, ☐ electrical and instrumentation, ☐ pipe repair, ☐ bursting CIPP, ☐ public relations, ☐ SSO/emergency response, ☐ pump station operations and maintenance, ☐ CCTV and trench/shoring, ☐ other?			
Which of these programs have formal curriculums?			
Does On-the-Job (OJT) training use Standard Operating and Standard Maintenance Procedures (SOPs & SMPs)?			
Is OJT progress and performance measured?			
Does the owner or operator have mandatory training requirements identified for key employees?			
What percentage of employees met or exceeded their annual training goals during the past year?			
Which of the following methods are used to assess the effectiveness of the training: ☐ periodic testing, ☐ drills, ☐ demonstration, ☐ none?			
What percentage of the training offered by the owner or operator is in the form of the following: manufacturer training, on-the-job training, in-house classroom training, industry-wide training?			

Comments:

III. C. Collection System Management: Communication and Customer Service

Question	Response	Documentation Available	
		Yes	No
What type of public education/outreach programs does the owner or operator have about user rates?			
Do these programs include communication with groups such as local governments, community groups, the media, schools, youth organizations, senior citizens? List applicable groups.			
Is there a public relations program in place?			
Are the employees of the collection system trained in public relations?			
Are there sample correspondence or "scripts" to help guide staff through written or oral responses to customers?			
What methods are used to notify the public of major construction or maintenance work: ☐ door hangers, ☐ newspaper, ☐ fliers, ☐ signs, ☐ other, ☐ none?			
Is the homeowner notified prior to construction that his/her property may be affected?			
Is information provided to residents on cleanup procedures following basement backups and overflows from manholes when they occur?			
Which of the following methods are used to communicate with system staff: ☐ regular meetings, ☐ bulletin boards, ☐ e-mail, ☐ other?			
How often are staff meetings held (e.g., daily, weekly, monthly)?			
Are incentives offered to employees for performance improvements?			
Does the owner or operator have an "Employee of the Month/Quarter/Year" program?			

Question	Response	Documentation Available	
		Yes	No
How often are performance reviews conducted (e.g., semi-annually, annually, etc.)?			
Does the owner or operator regularly communicate with other municipal departments?			
Does the owner or operator have a formal procedure in place to evaluate and respond to complaints?			
What are the common complaints received?			
Does the owner or operator have a process for customer evaluation of the services provided?			
Do customer service records include the following information: ☐ personnel who received the complaint or request, ☐ nature of complaint or request, ☐ to whom the follow-up action was assigned, ☐ date of the complaint or request, ☐ date the complaint or request was resolved, ☐ customer contact information, ☐ location of the problem, ☐ date the follow-up action was assigned, ☐ cause of the problem, ☐ feedback to customer?			
Does the owner or operator have a goal for how quickly customer complaints (or emergency calls) are resolved?			
What percentage of customer complaints (or emergency calls) are resolved within the timeline goals?			
How are complaint records maintained? (i.e., computerized) Is this information used as the basis for other activities such as routine preventative maintenance?			

Comments:

III. D. Collection System Management: Management Information Systems

Question	Response	Documentation Available	
		Yes	No
What types of work reports are prepared by the O&M Staff?			
Do the work reports include enough information? (See example report forms)			
How are records kept?			
Are records maintained for a period of at least three years?			
Are the records able to distinguish activities taken in response to an overflow event?			
Does the owner or operator use computer technology for its management information system? (Computer Based Maintenance Management Systems, spreadsheets, data bases, SCADA, etc). If so, what type of system(s) is used?			
Are there written instructions for managing and tracking the following information: ☐ complaint work orders, ☐ scheduled work orders, ☐ customer service, ☐ scheduled preventative maintenance, ☐ scheduled inspections, ☐ sewer system inventory, ☐ safety incidents, ☐ scheduled monitoring/sampling, ☐ compliance/overflow tracking, ☐ equipment/tools tracking, ☐ parts inventory?			
Do the written instructions for tracking procedures include the following information: ☐ accessing data and information, ☐ instructions for using the tracking system, ☐ updating the MIS, ☐ developing and printing reports?			
How often is the management information system updated (immediately, within one week of the incident, monthly as time permits)?			

Comments:

III. E. Collection System Management: SSO Notification Program

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have standard procedures for notifying state agencies, health agencies, the regulatory authority, and the drinking water purveyor of overflow events?			
Are above notification procedures dependent on the size or location of the overflow? If so, describe this procedure.			
Is there a Standard form for recording overflow events? Does it include location, type, receiving water, estimated volume, cause?			
Are chronic SSO locations posted?			

Comments:

III. F. Collection System Management: Legal Authority

Question	Response	Documentation Available	
		Yes	No
Does the collection system receive flow from satellite communities?			
What is the total area from satellite communities that contribute flow to the collection system (acres or square miles)?			
Does the owner or operator require satellite communities to enter into an agreement?			
Does the agreement include the requirements listed in the sewer use ordinance (SUO)?			
Do the agreements have a date of termination and allow for renewal under different terms?			
Does the owner or operator maintain the legal authority to control the maximum flow introduced into the collection system from satellite communities?			
Are standards, inspections, and approval for new connections clearly documented in a SUO?			
Does the SUO require satellite communities to adopt the same industrial and commercial regulator discharge limits as the owner or operator?			
Does the SUO require satellite communities to adopt the same inspection and sampling schedules as required by the pretreatment ordinance?			
Does the SUO require the satellite communities or the owner or operator to issue control permits for significant industrial users?			
Does the SUO contain provisions for addressing overstrength wastewater from satellite communities?			
Does the SUO contain procedures for the following: inspection standards, pretreatment requirements, building/sewer permit issues?			

Does the SUO contain general prohibitions of the following materials: ☐ fire and explosion hazards, ☐ oils or petroleum, ☐ corrosive materials, ☐ materials which may cause interference at the wastewater treatment plant, ☐ obstructive materials?			
Does the SUO contain procedures and enforcement actions for the following: ☐ fats, oils, and grease (FOG); ☐ I/I; building structures over the sewer lines; ☐ storm water connections to sanitary lines; ☐ defects in service laterals located on private property; ☐ sump pumps, air conditioner?			

Comments:

IV. A. Collection System Operation: Budgeting

Question	Response	Documentation Available	
		Yes	No
What are the owner or operator's current rates?			
What is the average annual fee for residential users?			
How are user rates calculated?			
How often are user charges evaluated and adjusted based on that evaluation?			
How many rate changes have there been in the last 10 years and what were they?			
Does the owner or operator receive sufficient funding from its revenues?			
Are collection system enterprise funds used for non-enterprise fund activities?			
Is there a budget for annual operating costs?			
Does the budget provide sufficient line item detail for labor, materials and equipment?			
Are costs for collection system O&M separated from other utility services, i.e., water, storm water and treatment plants?			
Do O&M managers have current O&M budget data?			
What is the collection system's average annual O&M budget?			
What percentage of the collection system's overall budget is allocated to maintenance of the collection system?			
Does the owner or operator have a Capital Improvement Plan (CIP) that provides for system repair/replacement on a prioritized basis?			
What is the collection system's average annual CIP budget?			

Question	Response	Documentation Available	
		Yes	No
What percentage of the maintenance budget is allotted to the following maintenance: Predictive maintenance (tracking design, life span, and scheduled parts replacement), preventative maintenance (identifying and fixing system weakness which, if left unaddressed, could lead to overflows), corrective maintenance (fixing system components that are functioning but not at 100% capacity/efficiency), emergency maintenance (reactive maintenance, overflows, equipment breakdowns).			
Does the owner or operator have a budgeted program for the replacement of under-capacity pipes?			
Does the owner or operator have a budgeted program for the replacement of over-capacity pipes?			
Are O&M staff involved in O&M budget preparation?			
How are priorities determined for budgeting for O&M during the budget process?			
Does the owner or operator maintain a fund for future equipment and infrastructure replacement?			
How is new work typically financed?			

Comments:

IV. B. Collection System Operation: Compliance

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have inter-jurisdictional or inter-municipal agreements?	Already asked		
Is there a sewer-use and a grease ordinance?			
Is there a process in place for enforcing sewer and grease ordinances?			
Are all grease traps inspected regularly?			
How does the owner or operator learn of new or existing unknown grease traps?			
Who is responsible for enforcing the sewer ordinance and grease ordinance? Does this party communicate with the utility department on a regular basis?			
Are there any significant industrial dischargers to the system?			
Is there a pretreatment program in place? If so, please describe.			
Is there an ordinance dealing with private service laterals?			
Is there an ordinance dealing with storm water connections or requirements to remove storm water connections?			

Comments:

IV. C. Collection System Operation: Water Quality Monitoring

Question	Response	Documentation Available	
		Yes	No
Is there a water quality monitoring program in the service areas?			
If so, who performs the monitoring?			
How many locations are monitored?			
What parameters are monitored and how often?			
Is water quality monitored after an SSO event?			
Are there written standard sampling procedures available?			
Is analysis performed in-house or by a contract laboratory?			
Are chain-of-custody forms used?			

Comments:

IV. D. Collection System Operation: Hydrogen Sulfide Monitoring and Control

Question	Response	Documentation Available	
		Yes	No
Are odors a frequent source of complaints? How many?			
Are the locations of the frequent odor complaints documented?			
What is the typical sewer slope? Does the owner or operator take hydrogen sulfide corrosion into consideration when designing sewers?			
Does the collection system owner or operator have a hydrogen sulfide problem, and if so, does it have in place corrosion control programs? What are the major elements of the program?			
Does the owner or operator have written procedures for the application of chemical dosages?			
Are chemical dosages, dates, and locations documented?			
Does the owner or operator have a program in place for renewing or replacing severely corroded sewer lines to prevent collapse?			
Are the following methods used for hydrogen sulfide control: ☐ aeration, ☐ iron salts, ☐ enzymes, ☐ activated charcoal canisters, ☐ chlorine, ☐ sodium hydroxide, ☐ hydrogen peroxide, ☐ potassium permanganate, ☐ biofiltration, ☐ others?			
Does the system contain air relief valves at the high points of the force main system?			
How often are th valves maintained and inspected (weekly, monthly, etc.)?			
Does the owner or operator enforce pretreatment requirements?			

Comments:

IV. E. Collection System Operation: Safety

Question	Response	Documentation Available	
		Yes	No
Is there a documented safety program supported by the top administration official?			
Is there a Safety Department that provides training, equipment, and an evaluation of procedures?			
If not, who provides safety training?			
Does the owner or operator have written procedures for the following: ☐ lockout/tagout, ☐ MSDS, ☐ chemical handling, ☐ confined spaces permit program, ☐ trenching and excavations, ☐ biological hazards in wastewater, ☐ traffic control and work site safety, ☐ electrical and mechanical systems, ☐ pneumatic and hydraulic systems safety?			
What is the agency's lost-time injury rate(percent or in hours)?			
Is there a permit required confined space entry procedure for manholes, wetwells, etc.? Are confined spaces clearly marked?			
Are the following equipment items available and in adequate supply: ☐ rubber/disposable gloves; ☐ confined space ventilation equipment; ☐ hard hats, ☐ safety glasses, ☐ rubber boots; ☐ antibacterial soap and first aid kit; ☐ tripods or non-entry rescue equipment; ☐ fire extinguishers; ☐ equipment to enter manholes; ☐ portable crane/hoist; ☐ atmospheric testing equipment and gas detectors; ☐ oxygen sensors; ☐ H_2S monitors; ☐ full body harness; ☐ protective clothing; ☐ traffic/public access control equipment; ☐ 5-minute escape breathing devices; ☐ life preservers for lagoons; ☐ safety buoy at activated sludge plants; ☐ fiberglass or wooden ladders for electrical work; ☐ respirators and/or self-contained breathing apparatus; ☐ methane gas or OVA analyzer; ☐ LEL metering?			
Are safety monitors clearly identified?			
How often are safety procedures reviewed and revised?			

Question	Response	Documentation Available	
		Yes	No
Are workplace accidents investigated?			
How does the Administration communicate with field personnel on safety procedures; memo, direct communication, video, etc.?			
Is there a Safety Committee with participation by O&M staff? How often does it meet?			
Is there a formal Safety Training Program? Are records of training maintained?			

Comments:

IV. F. Collection System Operation: Emergency Preparedness and Response

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have an emergency response plan? A contingency plan?			
How often is the plan reviewed and updated? What was the date it was last updated?			
Does the plan take into consideration vulnerable points in the system, severe natural events, failure of critical system components, vandalism or other third party events, and a root cause analysis protocol?			
Are staff trained and drilled to respond to emergency situations? Are responsibilities detailed for all personnel who respond to emergencies?			
Are there emergency operation procedures for equipment and processes?			
Does the owner or operator have standard procedures for notifying state agencies, local health departments, the regulatory authority, and drinking water authorities of significant overflow events?			
Does the procedure include an up-to-date list of the names, titles, phone numbers, and responsibilities of all personnel involved?			
Do work crews have immediate access to tools and equipment during emergencies?			
Is there a public notification plan? If so, does it cover both regular business hours and off-hours?			
Does the owner or operator have procedures to limit public access to and contact with areas affected with SSOs?			
Does the owner or operator use containment techniques to protect the storm drainage systems?			

Do the overflow records include the following information: ☐ date and time, ☐ cause(s), ☐ names of affected receiving water(s), ☐ location, ☐ how it was stopped, ☐ any remediation efforts, ☐ estimated flow/volume discharged, ☐ duration of overflow?			
Does the owner or operator have signage to keep public from affected area?			
Is there a hazard classification system? Where is it located?			
Does the owner or operator conduct vulnerability analyses?			
Are risk assessments performed? How often?			

Comments:

IV. G. Collection System Operation: Modeling

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a hydraulic model of the collection system including pump stations? What model is used?			
What uses does the model serve (predicting flow capacity, peak flows, force main pressures, etc.)?			
Does the model produce results consistent with observed conditions?			
Is the model kept up to date with respect to new construction and repairs that may affect hydraulic capacity?			

Comments:

IV. H. Collection System Operation: Engineering - System Mapping and As-built Plans (Record Drawings)

Question	Response	Documentation Available	
		Yes	No
What type of mapping/inventory system is used?			
Is the mapping tied to a GPS system?			
Are "as-built" plans (record drawings) or maps available for use by field crews in the office and in the field?			
Do field crews record changes or inaccuracies and is there a process in place to update "as built" plans (record drawings)?			
Do the maps show the date the map was drafted and the date of the last revision?			
Do the sewer line maps include the following: ☐ scale; ☐ north arrow; ☐ date the map was drafted; ☐ date of the last revision; ☐ service area boundaries; ☐ property lines; ☐ other landmarks; ☐ manhole and other access points; ☐ location of building laterals; ☐ street names; ☐ SSOs/CSOs; ☐ flow monitors; ☐ force mains; ☐ pump stations; ☐ lined sewers; ☐ main, trunk, and interceptor sewers; ☐ easement lines and dimensions; ☐ pipe material; ☐ pipe diameter; ☐ pipe diameter; ☐ installation date; ☐ slope; ☐ manhole rim elevation; ☐ manhole coordinates; ☐ manhole invert elevation; ☐ distance between manholes?			
Are the following sewer attributes recorded: ☐ size, ☐ shape, ☐ invert elevation, ☐ material, ☐ separate/combined sewer, ☐ installation date?			
Are the following manhole attributes recorded: ☐ shape, ☐ type, ☐ depth, ☐ age, ☐ material?			
Is there a systematic numbering and identification method/system established to identify sewer system manhole, sewer lines, and other items (pump stations, etc.)?			

Comments:

IV. I. Collection System Operation: Engineering - Design

Question	Response	Documentation Available	
		Yes	No
Is there a document which details design criteria and standard construction details?			
Is life cycle cost analysis performed as part of the design process?			
Is there a document that describes the procedures that the owner or operator follows in conducting design review? Are there any standard forms that are used as a guide?			
Are O&M staff involved in the design review process?			
Does the owner or operator have documentation on private service lateral design and inspection standards?			
Does the owner or operator attempt to standardize equipment and sewer system components?			

Comments:

IV. J. Collection System Operation: Engineering - Capacity

Question	Response	Documentation Available	
		Yes	No
What procedures are used in determining whether the capacity of existing gravity sewer system, pump stations and force mains are adequate for new connections?			
Is any metering of flow performed prior to allowing new connections?			
Is there a hydraulic model of the system used to predict the effects of new connections?			
Is there any certification as to the adequacy of the sewer system to carry additional flow from new connections required?			

Comments:

IV. K. Collection System Operation: Engineering - Construction

Question	Response	Documentation Available	
		Yes	No
Who constructs new sewers? If other than the owner or operator, does the owner or operator review and approve the design?			
Is there a document that describes the procedures that the owner or operator follows in conducting their construction inspection and testing program?			
Are there any standard forms that guide the owner or operator in conducting their construction inspection and testing program?			
Is new construction inspected by the owner or operator or others?			
What are the qualifications of the inspector(s)?			
What percentage of time is a construction inspector on site?			
Is inspection supervision provided by a registered professional engineer?			
How is the new gravity sewer construction tested? (Air, water, weirs, etc.)			
Are new manholes tested for inflow and infiltration?			
Are new gravity sewers televised?			
What tests are performed on pump stations?			
What tests are performed on force mains?			
Is new construction built to standard specifications established by the owner or operator and/or the State?			
Is there a warranty for new construction? If so, is there a warranty inspection done at the end of this period?			

Comments:

IV. L. Collection System Operation: Pump Station Operation

Question	Response	Documentation Available	
		Yes	No
How many pump stations are in the system? How many have backup power sources?			
Are enough trained personnel assigned to properly maintain pump stations?			
Are these personnel assigned full-time or part-time to pump station duties?			
Are there manned and un-manned pump stations in the system? How many of each?			
Is there a procedure for manipulating pump operations (manually or automatically during wet weather to increase in-line storage of wet weather flows?			
Are well-operating levels set to limit pump start/stops?			
Are the lead, lag, and backup pumps rotated regularly?			

Comments:

IV. L. 1. Collection System Operation: Pump Stations - Inspection

Question	Response	Documentation Available	
		Yes	No
How often are pump stations inspected?			
What work is accomplished during inspections?			
Is there a checklist?			
Are records maintained for each inspection?			
What are the average annual labor hours spent on pump station inspections?			
Are there Standard Operating Procedures (SOPs) and Standard Maintenance Procedures (SMPs) for each station?			
What are the critical operating characteristics maintained for each station? Are the stations maintained within these criteria?			

Comments:

IV. L. 2. Collection System Operation: Pump Stations - Emergencies

Question	Response	Documentation Available	
		Yes	No
Is there an Emergency Operating Procedure for each pump station?			
Is there sufficient redundancy of equipment in all pump stations?			
Who responds to lift station failures and overflows? How are they notified?			
How is loss of power at a station dealt with? (i.e. on-site electrical generators, alternate power source, portable electric generator(s))			
What equipment is available for pump station bypass?			
What process is used to investigate the cause of pump station failure and take necessary action to prevent future failures?			

Comments:

IV. L. 3. Collection System Operation: Pump Stations - Emergency Response and Monitoring

Question	Response	Documentation Available	
		Yes	No
How are lift stations monitored?			
If a SCADA system is used, what parameters are monitored?			

Comments:

IV. L. 4. Collection System Operation: Pump Stations - Recordkeeping

Question	Response	Documentation Available	
		Yes	No
Are operations logs maintained for all pump stations?			
Are manufacturer's specifications and equipment manuals available for all equipment?			
Are pump run times maintained for all pumps?			
Are elapsed time meters used to assess performance?			

Comments:

IV. L. 5. Collection System Operation: Pump Stations - Force Mains and Air/Vacuum Valves

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator regularly inspect the route of force mains?			
Does the owner or operator have a program to regularly assess force main condition?			
Is there a process in place to investigate the cause of force main failures?			
Does the owner or operator have a regular maintenance/inspection program for air/vacuum valves?			
Have force main failures been caused by water hammer?			

Comments:

V. A. Equipment and Collection System Maintenance: Maintenance Budgeting

Question	Response	Documentation Available	
		Yes	No
How does the collection system owner or operator track yearly maintenance costs?			
Is there a maintenance cost control system?			
Are maintenance costs developed from past cost records?			
How does the owner or operator categorize costs? Preventive? Corrective? Projected Costs? Projected Repair?			
How does the owner or operator control expenditures?			

Comments:

V. B. Equipment and Collection System Maintenance: Planned Maintenance

Question	Response	Documentation Available	
		Yes	No
Are preventive maintenance tasks and frequencies established for all pump stations and equipment?			
How were preventive maintenance frequencies established?			
What percentage of the operator's time is devoted to planned as opposed to unplanned maintenance?			
What predictive maintenance techniques are used as part of PM program?			
Is there a formal procedure to repair or replace pump stations and equipment when useful life is reached?			
Has an energy audit been performed on pump station electrical usage?			
Is an adequate parts inventory maintained for all equipment?			
Is there a sufficient number of trained personnel to properly maintain all stations?			
Who performs mechanical and electrical maintenance?			
Are there Standard Maintenance Procedures (SMPs) for each station?			

Comments:

V. C. Equipment and Collection System Maintenance: Maintenance Scheduling

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator plan and schedule preventive and corrective maintenance activities?			
Is there an established priority system? Who sets priorities for maintenance?			
Is a maintenance card or record kept for each piece of mechanical equipment within the collection system?			
Do equipment maintenance records include the following information: ☐ maintenance recommendations, ☐ instructions on conducting the specific maintenance activity, ☐ other observations on the equipment, ☐ maintenance schedule, ☐ a record of maintenance on the equipment to date.			
Are dated tags used to show out-of-service equipment?			
Is maintenance backlog tracked?			
How is O&M performance tracked and measured?			
What percent of repair finds are spent on emergency repairs?			
Are corrective repair work orders backlogged more than six months?			
Is maintenance performed for other public works divisions?			
How are priorities determined for this work?			
How is this work funded?			
Are maintenance logs maintained for all pump stations?			

Comments:

V. D. Equipment and Collection System Maintenance: Maintenance Right-of-Way

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator perform scheduled maintenance on Rights-of-Way and Easements?			
Does the owner or operator monitor street paving projects?			
Does the owner or operator have a program to locate and raise manholes (air valves, etc) as needed?			
How are priorities determined?			
How is the effectiveness of the maintenance schedule measured?			

Comments:

V. E. Equipment and Collection System Maintenance: Sewer Cleaning

Question	Response	Documentation Available	
		Yes	No
Is there a routine schedule for cleaning sewer lines on a system wide basis, *e.g.*, at the rate of once every seven to twelve years or a rate of between 8% and 14% per year?			
What is the owner or operator's goals for annual system cleaning?			
What percent of the sewer lines are cleaned, even high/repeat cleaning trouble spots, during the past year?			
Is there a program to identify sewer line segments that have chronic problems and should be cleaned on a more frequent schedule?			
What is the average number of stoppages experienced per mile of sewer pipe per year?			
Has the number of stoppages increased, decreased, or stayed the same over the past five years?			
Are stoppages diagnosed to determine the cause?			
Are stoppages plotted on maps and correlated with other data such as pipe size and material, or location?			
Do the sewer cleaning records include the following information: ☐ date and time, ☐ cause of stoppage, ☐ method of cleaning, location of stoppage or routine cleaning activity, ☐ identity of cleaning crew, ☐ further actions necessary/initiated?			
If sewer cleaning is done by a contractor are videos taken of before and after cleaning?			

Comments:

V. E. 1. Equipment and Collection System Maintenance: Sewer Cleaning - Cleaning Equipment

Question	Response	Documentation Available	
		Yes	No
What type of cleaning equipment does the owner or operator use?			
How many cleaning units of each type does the owner or operator have? What is the age of each?			
How many cleaning crews and shifts does the owner or operator employ?			
How many cleaning crews are dedicated to preventive maintenance cleaning?			
How many cleaning crews are dedicated to corrective maintenance cleaning?			
What has the owner or operator's experience been regarding pipe damage caused by mechanical equipment?			
Where is the equipment stationed?			

Comments:

V. E. 2. Equipment and Collection System Maintenance: Sewer Cleaning - Chemical Cleaning and Root Removal

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a root control program?			
Does the owner or operator have a FOG program?			
Are chemical cleaners used?			
What types of chemical cleaners are used?			
How often are they applied?			
How are the chemical cleaners applied?			
What results are achieved through the use of chemical cleaners?			

Comments:

V. F. Equipment and Collection System Maintenance: Parts Inventory

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a central location for the storage of spare parts?			
Have critical spare parts been identified?			
Are adequate supplies on hand to allow for two point repairs in any part if the system?			
Is there a parts standardization policy in place?			
Does the owner or operator maintain a stock of spare parts on its maintenance vehicles?			
What method(s) does the owner or operator employ to keep track of the location, usage, and ordering of spare parts? Are parts logged out when taken by maintenance personnel for use?			
Does the owner or operator salvage specific equipment parts when equipment is placed out-of-service and not replaced?			
How often does the owner or operator conduct a check of the inventory of parts to ensure that their tracking system is working?			
Who has the responsibility of tracking the inventory?			
For those parts which are not kept in inventory, does the owner or operator have a readily available source or supplier?			

Comments:

V. G. Equipment and Collection System Maintenance: Equipment and Tools Management

Question	Response	Documentation Available	
		Yes	No
Is there a list of equipment and tools used for operation and maintenance?			
Do personnel feel they have access to the necessary equipment and tools to do all aspects of operation and maintenance of the collection system?			
Is there access to suitable equipment if the owner or operator's equipment is down for repair?			
Does the owner or operator own or have access to portable generators?			
Where does the owner or operator store its equipment?			
Is a detailed equipment maintenance log kept?			
Are written equipment maintenance procedures available?			
What is the procedure for equipment replacement?			
Are the services of an in-house vehicle and equipment maintenance services used?			
What is the typical turnaround time for equipment and vehicle maintenance?			

Comments:

VI. Management Information Systems: Performance Indicators

Question	Response	Documentation Available	
		Yes	No
How many sanitary sewer overflows (SSOs) have occurred in the last 5 years? How many less than 1,000 gallons?			
Does the owner or operator document and report all SSOs regardless of size?			
Does the owner or operator document basement backups?			
Are there areas that experience basement or street flooding?			
How many SSOs have reached "Waters of the US"? Is there a record?			
Approximately, what percent of SSOs discharge were from each of the following in the last 5 years: manholes, pump stations, main and trunk sewers, lateral and branch sewers, structural bypasses?			
What is the per capita wastewater flow for the maximum month and maximum week or day?			
What is average annual influent BOD?			
What is the ratio of maximum wet weather flow to average dry weather flow?			
Approximately, what percent of SSO discharge were caused by the following in the last 5 years: debris buildup, collapsed pipe, root intrusion, capacity limitations, excessive infiltration and inflow, FOG, vandalism?			
What percent of SSOs were released to: soil; surface water; basements; paved areas; coastal, ocean, or beach areas; rivers, lakes or streams?			
For surface water releases, what percent are to surface waters that could affect: contact recreation, shellfish growing areas, drinking water sources?			
How many chronic SSO locations are in the collection system?			

Are pipes with chronic SSOs being monitored for sufficient capacity and/or structural condition?			
Prior to collapse, are structurally deteriorating pipelines being monitored for renewal or replacement?			
What is the annual number of mainline sewer cave-ins? What was the cause (i.e. pipe corrosion, leaks, etc.)			
What other types of performance indicators does the owner or operator use?			

Comments:

VII. A. Sewer System Capacity Evaluation (SSES): Internal TV Inspection

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator use internal T.V. inspection? If so please describe the program.			
Do the internal TV record logs include the following: ☐ pipe size, type, length, and joint spacing; ☐ distance recorded by internal TV; ☐ results of the internal TV inspection; ☐ internal TV operator name; ☐ cleanliness of the line; ☐ location and identification of line being televised by manholes?			
Is a rating system used to determine the severity of the defects found during the inspection process?			
Is there documentation explaining the codes used for internal TV results reporting?			
Approximately what percent of the total defects determined by TV inspection during the past 5 years were the following:			
Are main line and lateral repairs checked by internal TV inspection after the repair(s) have been made?			

Comments:

VII. B. SSES: Survey and Rehabilitation (general)

Question	Response	Documentation Available	
		Yes	No
Have SSES's been performed in the past? If so, is documentation available?			
Has any sewer rehabilitation work been done in the past 15 years? If so, please describe?			
Does the owner or operator have standard procedures for performing SSES work?			
Do the SSES reports include recommendations for rehabilitation, replacement, and repair?			
Were defects identified in the SSES repaired?			
Does the owner or operator have a multi-year Capital Improvements Program that includes rehabilitation, replacement, and repair?			
How are priorities established for rehabilitation, replacement, and repair?			
Has the owner or operator established schedules for performing recommended rehabilitation, both short term and long term?			
Has funding been approved for the recommended rehabilitation?			
Is post rehabilitation flow monitoring used to assess the success of the rehabilitation?			

Comments:

VII. C. SSES: Sewer Cleaning Related to I/I Reduction

Question	Response	Documentation Available	
		Yes	No
Are sewers cleaned prior to flow monitoring?			
Are sewers cleaned prior to internal T.V. inspection?			
When cleaning, is debris removed from the system?			

Comments:

VII. D. SSES: Flow Monitoring

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a flow monitoring program? If so, please describe.			
Does the owner or operator have a comprehensive capacity assessment and planning program?			
Are flows measured prior to allowing new connections?			
Number of permanent meters? Number of temporary meters?			
What type(s) of meters are used?			
Number of rain gauges?			
How frequently are flow meters checked?			
Do the flow meter checks include: ☐ independent water level, ☐ checking the desiccant, ☐ velocity reading, ☐ cleaning away debris, ☐ downloading data, ☐ battery condition?			
Are records maintained for each inspection?			
Do the flow monitoring records include: ☐ descriptive location of flow meter, ☐ type of flow meter, ☐ frequency of flow meter inspection, ☐ frequency of flow meter calibration?			
Are flow data used for billing, capacity analysis, and/or I/I investigations?			
What is the ratio of peak wet weather flow to average dry weather flow at the wastewater treatment plant?			
Does the owner or operator have any wet weather capacity problems?			
Are low points or flood-plain areas monitored during rain events?			
Does the owner or operator have any dry weather capacity problems?			

VII. E. SSES: Smoke Testing and Dyed Water Flooding

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a smoke testing program to identify sources of inflow and infiltration into the system including private service laterals and illegal connections? If so please describe.			
Are there written procedures for the frequency and schedule of smoke testing?			
Is there a documented procedure for isolating line segments?			
Is there a documented procedure for notifying local residents that smoke testing will be conducted in the area?			
What is the guideline for the maximum amount of line to be tested at one time?			
Are there guidelines for the weather conditions under which smoke testing should be conducted?			
Do the written records contain location, address, and description of the smoking element that produced a positive result?			
What follow-up occurs as a result of positive results for smoke or dye testing?			
Is there a goal for the percent of the system smoke tested each year?			
What percent of the system has been smoke tested over the past year?			
Does the owner or operator have a dyed water flooding program If so please describe.			
Is there a goal for the percent of the system dye tested each year?			
What percent of the system has been dye tested over the past year?			
Does the owner or operator share smoke and dye testing equipment with another owner or operator?			

Comments:

VII. F. SSES: Manhole Inspection

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a routine manhole inspection and assessment program?			
What is the purpose of the inspection program?			
Does the owner or operator have a goal for the number of manholes inspected annually?			
How many manholes were inspected during the past year?			
Do the records for manhole/pipe inspection include the following: ☐ conditions of the frame and cover; ☐ evidence of surcharge; offsets or misalignments; ☐ atmospheric hazards measurements; ☐ details on the root cause of cracks or breaks in the manhole or pope including blockages; ☐ recording conditions of corbel, walls, bench, trough, and pipe seals; ☐ presence of corrosion, if repair is necessary; ☐ manhole identifying number/location; wastewater flow characteristics; ☐ accumulations of grease, debris, or grit; ☐ presence of infiltration, location, and estimated quantity; ☐ inflow from manhole covers?			
Are manholes susceptible to inflow identified and inspected on a regular frequency?			
Is there a data management system for tracking manhole inspection activities?			
What triggers whether a manhole needs rehabilitation?			
Does the owner or operator have a multi-year Capital Improvements Program that includes rehabilitation, replacement, and repair of manholes?			
How are priorities established for rehabilitation, replacement, and repair of manholes?			
Has the owner or operator established schedules for performing rehabilitation, both short term and long term of manholes?			

Question	Response	Documentation Available	
		Yes	No
Has funding been approved for the rehabilitation of manholes?			
Does the owner or operator have a grouting program?			

Comments:

VIII. A. Rehabilitation: Manhole Repairs

Question	Response	Documentation Available	
		Yes	No
What rehabilitation techniques are used for manhole repairs?			
How are priorities determined for manhole repairs?			
What type of documentation is kept?			
Does the owner or operator use manhole inserts?			
Are they used system wide or only on low lying manholes?			

Comments:

VIII. B. Rehabilitation: Mainline Sewers

Question	Response	Documentation Available	
		Yes	No
What type of main line repairs has the owner or operator used in the past?			
Does the owner or operator currently use any of above techniques for main line repairs? What other techniques is the owner or operator presently using?			
How are priorities established for main line repairs?			
What type of follow-up is performed after the repair (e.g., CCTV)?			

Comments:

Appendix A

EXAMPLE
COLLECTION SYSTEM PERFORMANCE
INDICATOR DATA
COLLECTION FORM

EXAMPLE
COLLECTION SYSTEM PERFORMANCE INDICATOR DATA COLLECTION FORM

I. General Information

A. Agency Name _____

B. Agency Address
Street _____
City _____ State _____ Zip _____

C. Contact Person _____

D. Telephone: Voice _____ Fax _____ Email _____

E. Data provided for latest fiscal/calendar year, 20___

II. Collection System Description

A. Service Area _____ Square miles

B. Population Served _____

C. System Inventory

Miles of gravity sewer	Miles of force main	Number of maintenance access structures	Number of pump stations	Number of siphons	Number of air, vacuum, or air/vacuum relief valves

D. Number of Service Connections:
Residential _____ Commercial _____ Industrial _____ Total _____

E. Lateral Responsibility (check one)
1. At main line connection only _____
2. From main line to property line or easement/cleanout _____
3. Beyond property line/cleanout _____
4. Other _____

F. System combined (storm and sanitary)? Yes ___ No ___ If yes, % combined ____

G. Average Annual Precipitation _____ inches

H. System Flow Characteristics (total for service area)

Peak Dry Weather Flow (MGD)	Peak Wet Weather Flow (MGD)	Average Daily Flow (MGD)

III. Special Conditions

A. Indicate local conditions that are accounted for during design, construction, operation, and maintenance of the collection system.

1. Precipitation: Yes ____ No _____ If yes, provide brief explanation _____
_____
_____

2. Terrain: Yes ____ No _____ If yes, provide brief explanation_____
_____

3. Soils: Yes ____ No _____ If yes, provide brief explanation _____
_____

4. Temperature: Yes ____ No _____ If yes, provide brief explanation _____
_____

5. Groundwater: Yes _____ No _____ If yes, provide brief explanation _____
_____

6. Geology: Yes ____ No _____ If yes, provide brief explanation _____
_____

7. Other: _____
_____

B. Is corrosion a significant problem? Yes ____ No ____
- Is there a corrosion control program in place? Yes ____ No ____

C. Is odor a significant problem? Yes ____ No ____
- Is there an odor control program in place? Yes ____ No ____

D. Is grease a significant problem? Yes ____ No ____
- Is there a grease control program in place? Yes ____ No ____

E. Are roots a significant problem? Yes ____ No ____
- Is there a root control program in place? Yes ____ No ____

IV. Age Distribution of Collection System

Age	Gravity Sewer, miles	Force Mains, miles or feet	Number of Pump Stations
0 - 25 years			
26 - 50 years			
51 - 75 years			
> 76 years			

V. Size Distribution of Collection System

Diameter in inches	Gravity Sewer, miles	Force Mains, miles or feet
8 inches or less		
9 - 18 inches		
19 - 36 inches		
> 36 inches		

VI. Distribution of Gravity Sewer By Material

A. Vitrified Clay Pipe (VCP) _____ Miles
B. Reinforced Concrete Pipe (RCP) _____ Miles
C. Unreinforced Concrete Pipe (CP) _____ Miles
D. Plastic (all types) _____ Miles
E. Brick _____ Miles
F. Other _____ Miles
G. Other _____ Miles
H. Other _____ Miles

VII. Distribution of Force Mains By Material

(circle one)

A. Reinforced Concrete Pipe (RCP) _____ miles or feet
B. Prestressed Concrete Cylinder Pipe (PCCP) _____ miles or feet
C. Asbestos Cement Pipe (ACP) _____ miles or feet
D. Polyvinyl Chloride (PVC) _____ miles or feet
E. Steel _____ miles or feet
F. Ductile Iron _____ miles or feet
G. Cast Iron _____ miles or feet
H. Techite (RPMP) _____ miles or feet
I. High Density Polyethylene (HDPE) _____ miles or feet
J. Fiberglass Reinforced Plastic (FRP) _____ miles or feet
K. Other _____ miles or feet

VIII. Preventive Maintenance of System

A. Physical Inspection of Collection System, Preventive Maintenance

Inspection Activity	Total Annual Labor Hours Expended for This Activity	Total Completed (Miles of Pipe or Manholes Inspected Annually)	Crew Size (s)
CCTV			
Visual Manhole Inspection, Surface Only			
Visual Manhole Inspection, Remove Cover			
Visual Gravity Line Inspection, Surface Only			
Visual Force Main Inspection, Surface Only			
Other (Sonar, etc.)			

B. Mechanical and Hydraulic Cleaning, Preventive Maintenance

Cleaning Activity	Total Annual Labor Hours Expended for This Activity	Total Annual Labor Hours Expended for Scheduled PM	Total Miles Cleaned Annually	Crew Size (s)	Range of Pipe Diameters Cleaned
Hydraulic Jet					
Bails, Kites, Scooters					
Combination Machines					
Rod Machines					
Hand Rodding					
Bucket Machines					
Chemical Root Control					
Chemical or Biological Grease Control					

IX. Dry Weather Stoppages

A. Number of stoppages, annually _____
B. Average time to clear stoppage _____
C. Number of stoppages resulting in overflows and/or backups annually _____
D. Total quantity of overflow(s) _____
E. Is there an established procedure for problem diagnosis? Yes ____ No ____
F. Are future preventive measures initiated based on diagnosis? Yes ____ No ____
G. What equipment is available for emergency response? _____

X. Repairs and Rehabilitation, Proactive

A. Number of annual spot repairs identified _____
B. Number of annual spot repairs completed _____
C. Percent of spot repairs contracted _____
D. Number of manholes identified for rehabilitation _____
E. Number of manholes rehabilitated annually _____
F. Percent of manhole repairs contracted _____
G. Feet of main line needing rehabilitation _____
H. Feet of main line rehabilitated _____
I. Percent of main line rehabilitation contracted _____
J. Number of manholes scheduled for rehabilitation under Capital Improvement Program (s) _____
K. Feet of main line scheduled for rehabilitation under Capital Improvement Program (s) _____

XI. Repairs and Rehabilitation, Reactive

A. Number of annual line features _____
B. Number of line repairs _____

XII. Pump Stations

A. Number of pump stations inspected _____
   - Frequency of inspections _____ (daily, every other day, weekly)
B. Number of inpsection crews _____
C. Crew size _____
D. Number of pump stations with pump capacity redundancy _____
E. Number of pump stations with backup power sources _____
F. Number of pump stations with dry weather capacity limitations _____
G. Number of pump stations with wet weather capacity limitations _____
H. Number of pump stations calibrated annually _____
I. Number of pump stations with permanent flowmeters _____
J. Number of pump stations with remote status monitoring _____
K. Number of pump stations with running time meters _____
L. Number of mechanical maintenance staff assigned to mechanical maintenance _____
M. Number of electrical maintenance staff assigned to electrical maintenance _____
N. Total labor hours scheduled annually for electrical and mechanical PM tasks _____
O. Total labor hours expended annually for electrical and mechanical PM tasks _____

XIII. Pump Station Failures, Dry Weather

A. Number of failures resulting in overflows/bypass or backup, annually _____
B. Total quantity of overflow/bypass _____ Gallons or MG
C. Average time to restore operational capability _____ hours
D. Total labor hours expended for electrical and mechanical corrective maintenance tasks _____
E. Is failure mode and effect diagnosed? Yes ___ No ___
F. Are future preventive measures initiated based on diagnosis? Yes ___ No ___
G. What equipment is available for emergency response? _____

XIV. Force Mains

A. Force mains inspected annually _____ miles or feet (visual surface inspection of alignment)
B. Force mains monitored annually _____ miles or feet (pressure profile, capacity)
C. Number of force main failures annually _____
D. Cause(s) of force main failures _____

XV. Air Relief/Vacuum Valves

A. What is frequency of valve inspections? _____
B. What is frequency of PM (backflushing, etc)? _____
C. Number of annual valve failures _____
D. Cause(s) of valve failures _____

XVI. System Operation and Maintenance Efficiency

A. Total full time or full time equivalent staff assigned to O & M (excluding administration staff but including line managers, supervisors) _____
B. Total estimated labor hours actually expended for active O & M tasks (this is the total above less hours for sick, vacation, holidays, training, breaks, etc., not directly related to performing O & M tasks) _____

XVII. Level of Service

A. Average annual rate for residential users _____
B. Rate based on: water consumption _____ Flat rate _____ Other _____
C. Number of complaints annually _____
D. Number of complaints that are agency responsibility _____
E. Number of public health or other warnings issued annually _____
F. Number of claims for damages due to backups annually _____
G. Total cost of claims settled annually _____

XVIII. Financial

A. Total annual revenue received from wastewater _____
   1. % of revenue for long-term debt _____
   2. % of revenue for treatment and disposal _____
   3. % of revenue for collection and conveyance _____
B. Current value of collection system assets _____
C. Annual O & M expenditure _____
D. Annual CIP expenditure for repair, replacement, or rehabilitation _____
E. Annual O & M training budget _____
F. Total number of O & M personnel (including administrative in O & M department) _____
G. Number of personnel with collection system certification _____
H. Number of personnel qualified for collection system certification _____
I. Amount of O & M budget allocated for contracted services _____
J. Hydroflush cost per foot _____
K. Rodding cost per foot _____
L. Bucketing cost per foot _____
M. CCTV cost per foot _____
N. Spot repairs, cost each _____

XIX. Safety

A. Total labor hours assigned to O & M _____
B. Number of lost time injuries _____
C. Total lost time days _____
D. Total cost of lost time injuries _____

XX. Regulatory

A. Total number of violations issued annually _____
B. Total cost of fines paid annually _____
C. What is minimum reportable quantity in gallons? _____
D. What is time reporting requirement? _____
E. Number of annual WWTP upsets due to wet weather flow _____

XXI. General

A. Has SSES been performed on system? Yes _____ No _____
B. Total O & M positions currently budgetd _____
C. Total O & M positions currently filled _____
D. Is computerized maintenance management system (s) used for O & M managing? Yes ____ No ___

E. Is GIS system used for O & M managing? Yes _____ No _____

XXII. Procedures or Other Documentation Available

A. Overflow, bypass and containment Yes _____ No _____
B. Problem evaluation and solution Yes _____ No _____
C. Cleanup procedure Yes _____ No _____
D. Failure mode and effect procedure Yes _____ No _____
E. O & M budget process Yes _____ No _____
F. O & M budget with line item detail Yes _____ No _____
G. Long-range CIP planning for system expansion, rehabilitation, and replacement Yes _____ No ____
H. Is there a written procedure for cleanup to mitigate effect of overflow? Yes _____ No _____
I. Is there a written procedure for containing overflows and bypasses? Yes _____ No _____
J. Is there an established procedure for containing overflows and bypasses? Yes _____ No _____
K. Is there an established procedure for problem evaluation and solution? Yes _____ No _____
L. Is there an established procedure for cleanup to mitigate effect of overflow? Yes _____ No _____
M. Is there a grease control program? Yes _____ No _____
N. Is there a pretreatment program? Yes _____ No _____
O. Is there a private source I/I reduction program? Yes _____ No _____
P. Do you have chronic O & M problems that are designed into your system? Yes _____ No _____
If yes, provide brief description _____
_____

Q. Do you have chronic O & M problems that are constructed into your system? Yes _____ No ____
If yes, provide brief description _____
_____

R. How would you rate your construction inspection program?
Very effective _____ Needs improvement _____ Poor _____

XXIII. Definitions/Clarifications

A. Maintenance access structures, most commonly manholes, in your system that are incorporated into your O & M program.

B. Pump capacity redundancy is the ability to maintain pumping at design capacity with the largest pump out of service.

C. Remote status monitoring is any remote monitoring system such as alarm telemetry or SCADA that provides remote pump station status information.

D. You will notice that in the section on stoppages and pump station failures, we are asking for dry weather incidents only. Dry weather system performance is a good indicator or effectiveness of O & M program. If you have wet weather information that you wish to provide also, please do.

E. Under the Special Conditions sections we are identifying conditions that are present in your system that require consideration during design, construction, and O & M of your system.

F. Any of the questions dealing with labor hours are designed to determine total labor hours irrespective of crew size or crews that are only assigned to cleaning, for example, less than full time.

G. Our goal is to obtain data that can be or are standardized and that are accurate. We also realize that some data may not be available; however, data can be accurately estimated. If you estimate data please follow with an (E).

H. If data is not available please indicate "NA." If data does not apply to your system, please indicate by "DNA."

I. Failure mode and effect refers to any established procedure you have to diagnose system failures to determine the cause and effect of the failure. This can apply to crews clearing stoppages or to pump station failures.

J. Pump station inspection (XII) means scheduled inspection by operators to verify station operation and perform PM. It excludes electrical or mechanical craft maintenance.

K. Stoppage in section IX refers only to stoppages other than pump stations. Pump stations are covered in Section XIII. Backup in this case refers to a basement or other structure backup as opposed to main line sewer backup.

XXIV. Additional Comments

Appendix B

EXAMPLE INTERVIEW SCHEDULE AND TOPICS

EXAMPLE INTERVIEW SCHEDULE AND TOPICS

Days 1 and 2 Interviews

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time, and Location
Senior Management	Discuss project expectations, report review and comment process. Overview of organizational structure and "culture". Identify sensitive issues and how to approach. Schedule			
Project Kick off Meeting	Overview and purpose of project. Interview and field assessment process. Report content and review process. Questions and answers	None		
Physical Inspection and Testing – Gravity sewer system	Visual Inspection, pipe alignment. CCTV Smoke and Dye Testing Other	Reports, inspection forms, performance data, inspection strategy, crew assignments and schedules, equipment available, current expenditures and budgeted amounts, area maps, Standard Operating Procedures, field maps.		

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time, and Location
Preventive Maintenance - Mechanical and hydraulic cleaning	High velocity jets and combination machines. Other hydraulic methods Rodding Machines Bucket Machines	Reports, performance data, preventive maintenance cleaning strategy, crew assignments and schedules, equipment available, current and budgeted, problem areas, Standard Operating Procedures, Standard Maintenance Procedures, problem diagnosis		
Chemical and biological cleaning	Root control Grease control Odor control Corrosion control	Grease control ordinance, enforcement, odor and corrosion control strategy, root control program, design for O&M considerations, materials used (MSDS), reports, performance data, preventive maintenance cleaning strategy, crew assignments and schedules, equipment available, current and budgeted, problem areas, Standard Operating Procedures, Standard Maintenance Procedures, problem diagnosis, public education, enforcement		
Pump Stations	Routine inspection Electrical and mechanical maintenance SCADA Standby/emergency systems Valves Forcemains	Logs, inspection sheets, Standard Maintenance Procedures, Standard Operating procedures, pump station inventory and attribute data base, spares inventory, Reports, performance data, preventive maintenance strategy, crew assignments and schedules, equipment available, current and budgeted, critical pump stations, Standard Operating Procedures, Standard Maintenance Procedures, problem diagnosis, preventive and predictive maintenance methods, maintenance tasks and frequencies, O&M manuals, capacity issues		

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time, and Location
Training and Certification	Training program, technical, supervisory and management. Certification program	Knowledge, skills and abilities, basic skills, career paths, minimum qualifications, certification, educational assistance program, internal and external training, OJT, training budget		
Work Management	Planning and scheduling work Materials management Priority Backlog management Procurement Manual or Computer Maintenance Management System (CMMS)	Complaints and emergencies normal hours and after hours. Corrective, preventive and predictive maintenance work orders, work backlog, labor utilization, reports,		

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time, and Location
Safety	Safety committee Safety meetings Safety enforcement Documentation of comprehensive safety training Compliance with safety regulations Documentation of effectiveness of safety program (e.g., reduction of accidents) Documentation of attendance and learning at safety training sessions	Policy and procedures for trenching, confined space, lockout tagout, PPE. Safety manual, formal training, tracking, accident investigation		
Financial	Annual O&M Budget Rates CIP for rehabilitation/rehab Non-enterprise fund allocations	O&M budget process, line item accounts, five year CIP plan, repair, rehabilitation, replacement strategy for pipes and pump stations		

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time, and Location
Construction and Repair	Emergency repair Spot repairs, gravity system Rehabilitation Lateral installation Inspection New Construction Testing	Reports, inspection forms, performance data, inspection strategy, crew assignments and schedules, equipment available, current and budgeted, area maps, Standard Operating Procedures, field maps,		
Fleet Management	Maintenance Replacement Availability Budgeting	Inventory, repair and replacement process, maintenance turn around time, preventive maintenance, Standard Operating Procedures, Standard Maintenance Procedures, CMMS,		

Day 3 - Field

Pump Stations

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time and Location
Pump Station Maintenance	Submersible Cast in place wet well dry well Prefabricated Grinder/Low Pressure System	Logs, O&M manuals, on-site procedures, vehicles and equipment, SCADA, Supervisory controls, electrical systems, flow meters, HVAC, variable speed systems, chronic problems, pumps and hydraulic systems.		

Day 4 – Field

Facilities and Crews

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time and Location
Facilities	Electrical and mechanical repair shops and equipment Warehouse and equipment storage areas Vehicle maintenance shops Crew areas; locker rooms, training areas, dispatch areas	Logs, O&M manuals, on-site procedures, vehicles and equipment, SCADA, Supervisory controls, electrical systems, flow meters, HVAC, variable speed systems, chronic problems, pumps and hydraulic systems,		
Crews Exit Interview	CCTV Cleaning Construction Repair Overview of findings for week	N/A None		

Appendix C

INFORMATION SOURCES

Information Sources
(Updated November 2004)

WEBSITES (water and/or wastewater-oriented; financial related)

EPA National Compliance Assistance Clearinghouse	www.epa.gov/clearinghouse
Compliance Assistance Centers	http://www.assistancecenters.net
Construction Industry Compliance Assistance Center	www.cicacenter.org
EPA NPDES website	http://www.epa.gov/npdes
EPA Operator On-Site Technical Assistance Program–104(g) (hands-on assistance to small municipal WWTP operators at no cost to community)	www.epa.gov/owm/mab/smcomm/104g/sstc.htm
EPA Office of Wastewater Management	www.epa.gov/owm
EPA Clean Water Tribal Grant Program	www.epa.gov/owm/mab/indian/cwisa.htm
EPA Colonias Program	www.epa.gov/owm/mab/mexican
EPA Clean Water State Revolving Loan Fund Program	www.epa.gov/owm/cwfinance/cwsrf
EPA Website (Headquarters & Regions)	www.epa.gov/
EPA Small Business Gateway	http://www.epa.gov/smallbusiness
Environmental Finance Center	http://sspa.boisestate.edu/efc
National Environmental Services Center/WV University	www.nesc.wvu.edu
Local Govt. Environmental Assistance Network	www.lgean.org
Rural Community Assistance Program (RCAP)	www.rcap.org
Water Environment Federation (WEF)	www.wef.org
AMSA	www.amsa-cleanwater.org/pubs/
American Water Works Assoc. (AWWA)	http://www.awwa.org/
National Association of Towns & Townships (NATAT)	http://www.natat.org/

PUBLICATIONS /TRAINING VIDEOS /NEWSLETTERS, etc.

EPA National Service Center For Environmental Publications (NSCEP)
USEPA/NSCEP
PO Box 42419
Cincinnati, OH 45242
Tele: 1-800-490-9198 or 513-489-8190 (fax: 513-489-8695)

EPA Office of Water Resource Center
Tele: 202-566-1729 (24 hours)
center.water-resources@epa.gov

National Environmental Services Center (formerly the National Small Flows Clearinghouse)
West Virginia University Small Business Gateway
P.O. Box 6064
Morgantown, WV 26506
Tele: 1-800-624-8301

California State University - Sacremento
Tele: 916-278-6142
(training videos, etc.)

List Compiled by Sharie Centilla, USEPA/OECA
centilla.sharie@epa.gov
33

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APPENDIX B

"Wastewater Collection System CMOM Program Self-Assessment Checklist"
EPA Region 1, February 2020

United States Environmental Protection Agency, EPA New England

Wastewater Collection System CMOM Program Self-Assessment Checklist (Feb 2020)

Name of your System:

Date of Self-Assessment:

Put an "A" in the final column for an issue you intend to address with future action, or leave blank if you have evaluated your program as sufficient.

I. General Information – Collection System Description

I	Question	Response	*Act
1	How many people are served by your wastewater collection system?		
2	What is the number of service connections to your collection system? How many: Manholes? Pump stations? Feet (or miles) of sewer? Force mains? Siphons?		
3	What is the age of your system (e.g., 30% over 30 years, 20% over 50 years, etc.)?		
4	What type(s) of collection system map is/are available and what percent of the system is mapped by each method (e.g., paper only, paper scanned into electronic, digitized, interactive GIS, etc.)? When was the map(s) last updated?		
5	If you have a systematic numbering and identification method/system established to identify sewer system manhole, sewer lines, and other items (pump stations, etc.), please describe.		
6	Are "as-built" plans (record drawings) or maps available and used by field crews in the office and in the field?		
7	Describe the type of asset management (AM) system you use (e.g. card catalog, spreadsheets, AM software program, etc.)		

* Put an "A" in the final column if this is an issue you intend to address with future action.

II. Continuing Sewer Assessment Plan

II	Question	Response	*Act
1	Under what conditions, if any, does the collection system overflow? Does it overflow during wet and/or dry weather? Has your system had problems with: □ hydraulic issues, □ debris, □ roots, □ Fats, Oils & Grease (FOG), □ vandalism blockages resulting in manhole overflows, □ basement backups, □ other (specify)? Describe your system's history of structural collapses, and PS or force main failures.		
2	How many SSOs have occurred in each of the last three calendar years? What is the most frequent cause?		
3	Of those SSOs, how many basement backups occurred in each of the last three calendar years? How are they documented?		
4	What is the ratio of peak wet-weather flow to average dry-weather flow at the wastewater treatment plant (or municipal boundary for satellite collection systems)?		
5	What short-term measures have been implemented or plan to be implemented to mitigate the overflows? If actions are planned, when will they be implemented?		
6	What long-term measures have been implemented or plan to be implemented to mitigate the overflows? If actions are planned, when will they be implemented?		
7	Describe your preventive maintenance program; how do you track it (e.g., card files, electronically, with specific software)?		
8	How do you prioritize investigations, repairs and rehabilitation? What critical and priority problem areas are addressed more frequently than the remainder of your system? How frequently are these areas evaluated?		
9	Are septage haulers required to declare the origin of their "load"? Are records of these declarations maintained? Do any of the declarations provide evidence of SSOs?		

* Put an "A" in the final column if this is an issue you intend to address with future action.

III.A. Collection System Management Organizational Structure

III.A	Question	Response	*Act
1	Do you have an organizational chart that shows the overall personnel structure for collection system operations, including operation and maintenance staff? Please attach your chart.		
2	For which jobs do you have up-to-date job descriptions that delineate responsibilities and authority for each position?		
3	How many staff members are dedicated to collection system maintenance? Of those, how many are responsible for any other duties, (e.g., road repair or maintenance, O&M of the storm water collection system)? If so, describe other duties.		
4	Are there any collection system maintenance position vacancies? How long has the position(s) been vacant?		
5	For which, if any, maintenance activities do you use an outside contractor?		
6	Describe any group purchase contracts you participate in.		

III.B. Collection System Management: Training

III.B	Question	Response	*Act
1	What types of training are provided to staff?		
2	Is training provided in the following areas: general safety, routine line maintenance, confined space entry, MSDS, lockout/tagout, biologic hazards, traffic control, record keeping, electrical and instrumentation, pipe repair, public relations, SSO/emergency response, pump station operations and maintenance, trench/shoring, other (describe)?		
3	Which training requirements are mandatory for key employees?		
4	How many collection system employees are certified (e.g. NEWEA certification program) and at what grade are they certified?		

* Put an “A” in the final column if this is an issue you intend to address with future action.

III.C. Collection System Management: Communication and Customer Service

III.C	Question	Response	*Act
1	Describe your public education/outreach programs (e.g., for user rates, FOG, extraneous flow, SSOs etc.)		
2	What are the most common collection system complaints? How many complaints have you received in each of the past three calendar years?		
3	Are formal procedures in place to evaluate and respond to complaints?		
4	How are complaint records maintained (i.e., computerized)? How are complaints tied to emergency response and operations and maintenance programs?		

III.D. Collection System Management: Management Information Systems

III.D	Question	Response	*Act
1	How do you manage collection system information? (Commercial software package, spreadsheets, data bases, SCADA, etc). What information and functions are managed electronically?		
2	What procedures are used to track and plan collection system maintenance activities?		
3	Who is responsible for establishing maintenance priorities? What records are maintained for each piece of mechanical equipment within the collection system?		
4	What is the backlog for various types of work orders?		
5	How do you track emergencies and your response to emergencies? How do you link emergency responses to your maintenance activities?		

* Put an “A” in the final column if this is an issue you intend to address with future action.

6	What written policies/protocols do you have for managing and tracking the following information: complaint work orders, scheduled work orders, customer service, scheduled preventative maintenance, scheduled inspections, sewer system inventory, safety incidents, emergency responses, scheduled monitoring/sampling, compliance/overflow tracking, equipment/tools tracking, parts inventory?		

III.E. Collection System Management: SSO Notification Program

III.E	Question	Response	*Act
1	What are your procedures, including time frames, for notifying state agencies, health agencies, regulatory authorities, and the drinking water authorities of overflow events?		
2	Do you use the state standard form for recording/reporting overflow events? If not, provide a sample copy of the form that is used.		

III.F. Collection System Management: Legal Authority

III.F	Question	Response	*Act
1	Are discharges to the sewer regulated by a sewer use ordinance (SUO)? Does the SUO contain procedures for controlling and enforcing the following: □ FOG; □ Infiltration/ Inflow (I/I); □ building structures over the sewer lines; □ storm water connections to sanitary lines; □ defects in service laterals located on private property; □ sump pumps?		
2	Who is responsible for enforcing various aspects of the SUO? Does this party communicate with your department on a regular basis?		
3	Summarize any SUO enforcement actions/activities that have occurred in the last three calendar years.		

* Put an “A” in the final column if this is an issue you intend to address with future action.

4	Do you have a program to control FOG entering the collection system? If so, which of the following does it include: □ permits, □ inspection □ enforcement? Are commercial grease traps inspected regularly and who is responsible for conducting inspections?		
5	Is there an ordinance dealing with storm water connections or requirements to remove storm water connections?		
6	Does the collection system receive flow from satellite communities? Which communities? How are flows from these satellite communities regulated? Are satellite flow capacity issues periodically reviewed?		
7	Does the collection system receive flow from private collection systems? If yes, how is flow from these private sources regulated? How are overflows dealt with? Provide details, including contact information for these private systems.		

IV.A. Collection System Operation: Financing

IV.A	Question	Response	*Act
1	Has an enterprise (or other) fund been established and what does it include: wastewater collection and treatment operations; collection system maintenance; long-term infrastructure improvements; etc.? Are the funds sufficient to properly fund future system needs?		
2	How are rates calculated (have you done a rate analysis)? What is the current sewer charge rate? When was it last increased? How much was the increase?		
3	What is your O&M budget?		
4	If an enterprise fund has not been established, how are collection system maintenance operations funded?		
5	Does a Capital Improvement Plan (CIP) that provides for system repair/replacement on a prioritized basis exist? What is the collection system's average annual CIP budget?		

* Put an "A" in the final column if this is an issue you intend to address with future action.

6	How do you account for the value of your system infrastructure for the Government Accounting Standards Board standard 34 (GASB 34)?		

IV.B. Collection System Operation: Hydrogen Sulfide Monitoring and Control

IV.B	Question	Response	*Act
1	Are odors a frequent source of complaints? How many have been received in the last calendar year?		
2	Do you have a hydrogen sulfide problem, and if so, do you have corrosion control programs? What are the major elements of the program?		
3	Does your system contain air relief valves at the high points of the force main system? How often are they inspected? How often are they exercised?		

IV.C. Collection System Operation: Safety

IV.C	Question	Response	*Act
1	Do you have a formal Safety Training Program? How do you maintain safety training records?		
2	Which of the following equipment items are available and in adequate supply: □ rubber/disposable gloves; □ confined space ventilation equipment; □ hard hats, □ safety glasses, □ rubber boots; □ antibacterial soap and first aid kit; □ tripods or non-entry rescue equipment; □ fire extinguishers; □ equipment to enter manholes; □ portable crane/hoist; □ atmospheric testing equipment and gas detectors; □ oxygen sensors; □ H2S monitors; □ full body harness; □ protective clothing; □ traffic/public access control equipment; □ 5-minute escape breathing devices; □ life preservers for lagoons; □ safety buoy at activated sludge plants; □ fiberglass or wooden ladders for electrical work; □ respirators and/or self-contained breathing apparatus; □ methane gas or OVA analyzer; □ LEL metering?		

* Put an “A” in the final column if this is an issue you intend to address with future action.

IV.D. Collection System Operation: Emergency Preparedness and Response

IV.D	Question	Response	*Act
1	Do you have a written collection system emergency response plan? When was the plan last updated? What departments are included in your emergency planning?		
2	Which of the following issues are considered: □ vulnerable points in the system, □ severe natural events (see also Section VII, below), □ failure of critical system components, □ vandalism or other third party events (specify), □ other types of incidents (specify)?		
3	How do you train staff to respond to emergency situations? Where are responsibilities detailed for personnel who respond to emergencies?		
4	How many emergency calls have you had in the past calendar year?		

IV.E. Collection System Operation: Engineering – Capacity

IV.E	Question	Response	*Act
1	How do you evaluate the capacity of your system and what capacity issues have you identified, if any? What is your plan to remedy the identified capacity issues?		
2	What procedures do you use to determine whether the capacity of existing gravity sewer system, pump stations and force mains are adequate for new connections? Who does this evaluation?		
3	Do you charge hook up fees for new development and if so, how are they calculated?		
4	Do you have a hydraulic model of your collection system? Is it used to predict the effects of system remediation and new connections?		

* Put an “A” in the final column if this is an issue you intend to address with future action.

IV.F. Collection System Operation: Pump Stations - Inspection

IV.F	Question	Response	*Act
1	How many pump stations are in the system? How often are pump stations inspected? How many are privately owned, and how are they inspected? Do you use an inspection checklist?		
2	Is there sufficient redundancy of equipment at all pump stations?		
3	How are pump stations monitored? If a SCADA system is used, what parameters are monitored?		
4	How many pump station/force main failures have you had in each of the last three years? Who responds to pump station/force main failures and overflows? How are the responders notified?		
5	How many pump stations are equipped with backup power sources? How many require portable generators? How many portable generators does your system own? Explain how the portable generators will be deployed during a system-wide electrical outage.		
6	Are operation logs maintained for all pump stations? Are the lead, lag, and backup pumps rotated regularly?		
7	Is there a procedure to modify pump operations (manually, or automatically), during wet weather to increase in-line storage of wet weather flows? If so, describe.		

V.A. Equipment and Collection System Maintenance: Sewer Cleaning

V.A	Question	Response	*Act
1	What is your schedule for cleaning sewer lines on a system-wide basis? At this frequency, how long will it take to clean the system? How are sewer cleaning efforts documented?		
2	How many linear miles of the collection system were cleaned in each of the past 3 calendar years?		

* Put an “A” in the final column if this is an issue you intend to address with future action.

3	How do you identify sewer line segments that have chronic problems and should be cleaned more frequently? Is a list of these areas maintained and cleaning frequencies established?		
4	Approximately, how many collection system blockages have occurred during the last calendar year, and what were the causes?		
5	Has the number of blockages increased, decreased, or stayed the same over the past five years?		
6	What equipment is available to clean sewers? Is any type of cleaning contracted to other parties? If yes, under what circumstances?		
7	Do you have a root control program? Describe its critical components.		

V.B. Equipment and Collection System Maintenance: Maintenance Right-of-Way

V.B	Question	Response	*Act
1	Is scheduled maintenance performed on Rights-of-Way and Easements? At what frequency? How many manholes in easement areas can not be located?		
2	Are road paving projects coordinated with the collection system operators? Have manholes been paved over? How many manholes in paved areas can not be located? Describe any systems in place for locating and raising manholes that have been paved over.		

V.C. Equipment and Collection System Maintenance: Parts Inventory

V.C	Question	Response	*Act
1	Do you have a central location for the storage of spare parts?		
2	How have critical spare parts been identified?		
3	How to you determine if adequate supplies on hand? Has an inventory tracking system been implemented?		

* Put an “A” in the final column if this is an issue you intend to address with future action.

VI.A. SSES: System Assessment

VI.A	Question	Response	*Act
1	Do POTW flow records or prior I/I or SSES programs indicate the presence of public/private inflow sources or sump pumps? Please Explain.		
2	If problems are related to I/I, has a Sewer System Evaluation Survey (SSES) been conducted? When? What is the status of the recommendations?		
3	Do you have a program to identify and eliminate sources of I/I into the system including private service laterals and illegal connections? If so, describe.		
4	Have private residences been inspected for sump pumps and roof leader connections?		
5	Are inspections to identify illicit connections conducted during the property transfer process?		
6	How many sump pumps and roof leaders have been identified? How many have been removed?		
7	Have follow-up homeowner inspections been conducted?		
8	What incentive programs exist to encourage residences to disconnect roof leaders & sump pumps? (i.e. matching funds, etc.)		
9	What disincentive programs exist to encourage residences to disconnect roof leaders & sump pumps? (i.e. fines, surcharges)		

VI.B. SSES: Manhole Inspection

VI.B	Question	Response	*Act
1	Do you have a manhole inspection and assessment program?		
2	Has a formal manhole inspection checklist been developed?		
3	How many manholes were inspected during the past calendar year?		

* Put an “A” in the final column if this is an issue you intend to address with future action.

VII. Flood Resilience

VII	Question	Response	*Act
1	Have you prepared plans and procedures for responding to extreme weather events that may result in flooding and loss of power? Have you reviewed the report "Preparing for Extreme Weather at Wastewater Utilities: Strategies and Tips," published by the New England Interstate Water Pollution Control Commission (NEIWPCC) in September 2016?		
2	Do you have sewer lines that are within a flood area displayed in the Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Agency (FEMA)? What types of flood areas? Do the manholes on these sewer lines have water-tight manhole covers?		
3	Are any of your pump stations located within FEMA FIRM flood areas? What types of flood areas? Have you implemented any structural measures to provide flood resilience?		
4	Are upgrades or expansions being considered for any pump stations located within FEMA FIRM flood areas? Have you considered flood risk mitigation measures such as those listed in Section 1.2.1.h of the 2016 revision of Technical Report #16 Guides for the Design of Wastewater Treatment Works (TR-16) published by NEIWPCC in your designs?		
5	Are any of your treatment plant facilities located within FEMA FIRM flood areas? What types of flood areas? Have you implemented any structural measures to provide flood resilience?		
6	Are upgrades or expansions being considered for any treatment plant facilities located within FEMA FIRM flood areas? Have you considered flood risk mitigation measures such as those listed in Section 1.2.1.h of TR-16 in your designs?		

* Put an "A" in the final column if this is an issue you intend to address with future action.

VIII. Energy Use

VIII	Question	Response	*Act
1	What is your annual energy cost for operating your system? For which pieces of equipment do you track energy use?		
2	Have you upgraded any of your pumps and motors to more energy efficient models? If so, please describe.		
3	Have you performed an energy audit in the past three years?		
4	Where do you use the most energy (fuel, electricity) in operating your collection system?		

IX. Other Actions

IX	Question	Response	*Act
1	Describe any other actions that you plan to take to improve your CMOM Program that are not discussed above.		

* Put an “A” in the final column if this is an issue you intend to address with future action.

APPENDIX C

"EPA New England Bacterial Source Tracking Protocol"
EPA Region 1, January 2012 Draft

EPA New England Bacterial Source Tracking Protocol

Draft – January 2012

Purpose

This document provides a common framework for EPA New England ("EPA-NE") staff to develop and implement bacterial source tracking sample events, and provides a recommended approach to watershed association, municipal, and State personnel. Adopted from Boston Water and Sewer Commission ("BWSC") (2004), Pitt (2004), and based upon fieldwork conducted and data collected by EPA-NE, the protocol relies primarily on visual observations and the use of field test kits and portable instrumentation during dry and wet weather to complete a screening-level investigation of stormwater outfall discharges or flows within the drainage system. When necessary, the addition of more conclusive chemical markers may be included. The protocol is applicable to most typical Municipal Separate Storm Sewer Systems ("MS4s") and smaller tributary streams. The smaller the upstream catchment area and/or more concentrated the flow, the greater the likelihood of identifying an upstream wastewater source.

Introduction

The protocol is structured into several phases of work that progress through investigation planning and design, laboratory coordination, sample collection, and data evaluation. The protocol involves the concurrent collection and analyses of water samples for surfactants, ammonia, total chlorine, and bacteria. When more precise confirmation regarding the presence or absence of human sanitary sewage is necessary, and laboratory capacity is available, the additional concurrent collection of samples for select Pharmaceutical and Personal Care Product ("PPCP") analysis is advised. When presented with a medium to large watershed or numerous stormwater outfalls, the recommended protocol is the screening of all outfalls using the surfactant, ammonia, total chlorine, and bacterial analyses, in addition to a thorough visual assessment. The resulting data and information should then be used to prioritize and sample a subset of outfalls for all parameters, including PPCP compounds and additional analyses as appropriate. Ideally, screening-level analyses can be conducted by state, municipal, or local watershed association personnel, and a prioritized sub-set of outfalls can be sampled through a commercial laboratory or by EPA-NE using more advanced confirmatory techniques.

Step I – Reconnaissance and Investigation Design

Each sample event should be designed to answer a specific problem statement and work to identify the source of contamination. Any relevant data or reports from State, municipal, or local watershed associations should be reviewed when selecting sample locations. Aerial photography, mapping services, or satellite imagery resources are available free to the public through the internet, and offer an ideal way to pre-select locations for either field verification or sampling.

Sample locations should be selected to segregate outfall sub-catchment areas or surface waters into meaningful sections. A common investigative approach would be the identification of a

specific reach of a surface water body that is known to be impaired for bacteria. Within this specific reach, stormwater outfalls and smaller tributary streams would be identified by desktop reconnaissance, municipal outfall mapping, and field investigation when necessary. Priority outfalls or areas to field verify the presence of outfalls should be selected based on a number of factors, including but not limited to the following: those areas with direct discharges to critical or impaired waters (e.g. water supplies, swimming beaches); areas served by common/twin-invert manholes or underdrains; areas with inadequate levels of sanitary sewer service, Sanitary Sewer Overflows ("SSOs") or the subject of numerous/chronic sanitary sewer customer complaints; formerly combined sewer areas that have been separated; culverted streams, and; outfalls in densely populated areas with older infrastructure. Pitt (2004) provides additional detailed guidance.

When investigating an area for the first time, the examination of outfalls in dry-weather is recommended to identify those with dry-weather flow, odor, and the presence of white or gray filamentous bacterial growth that is common (but not exclusively present) in outfalls contaminated with sanitary sewage (see Attachment 1 for examples). For those outfalls with dry-weather flow and no obvious signs of contamination, one should never assume the discharge is uncontaminated. Sampling by EPA-NE staff has identified a number of outfalls with clear, odorless discharges that upon sampling and analyses were quite contaminated. Local physical and chemical conditions, in addition to the numerous causes of illicit discharges, create outfall discharges that can be quite variable in appearance. Outfalls with no dry-weather flow should be documented, and examined for staining or the presence of any obvious signs of past wastewater discharges downstream of the outfall.

As discussed in BWSC (2004), the protocol may be used to sample discreet portions of an MS4 sub-catchment area by collecting samples from selected junction manholes within the stormwater system. This protocol expands on the BWSC process and recommends the concurrent collection of bacteria, surfactant, ammonia, and chlorine samples at each location to better identify and prioritize contributing sources of illicit discharges, and the collection of PPCP compounds when more conclusive source identification is necessary.

Finally, as discussed further in Step IV, application of this sampling protocol in wet-weather is recommended for most outfalls, as wet-weather sampling data may indicate a number of illicit discharge situations that may not be identified in dry weather.

Step II – Laboratory Coordination

All sampling should be conducted in accordance with a Quality Assurance Project Plan ("QAPP"). A model QAPP is included as Attachment 2. While the QAPP details sample collection, preservation, and quality control requirements, detailed coordination with the appropriate laboratory staff will be necessary. Often sample events will need to be scheduled well in advance. In addition, the sampling team must be aware of the strict holding time requirements for bacterial samples – typically samples analysis must begin within 6 hours of sample collection. For sample analyses conducted by a commercial laboratory, appropriate

coordination must occur to determine each facilities respective procedures and requirements. The recommendations in this protocol are based on the use of a currently unpublished EPA-NE modification to *EPA Method 1694 – Pharmaceuticals and Personal Care Products in Water, Soil, Sediment, and Biosolids by HPLC/MS/MS*. Several commercial laboratories may offer Method 1694 capability. EPA-NE recommends those entities wishing to utilize a contract laboratory for PPCP analyses ensure that the laboratory will provide quantitative analyses for acetaminophen, caffeine, cotinine, carbamazepine, and 1,7-dimethylexanthine, at Reporting Limits similar to those used by EPA-NE (See Attachment 3). Currently, the EPA-NE laboratory has limited capacity for PPCP sampling, and any proposed EPA-NE PPCP sample events must be coordinated well in advance with the appropriate staff.

Step III – Sample Collection

Once a targeted set of outfalls has been selected, concurrent sampling and analyses for surfactants, ammonia, and total chlorine (which can all be done through the use of field kits), in addition to bacteria (via laboratory analysis) should be conducted. When numerous outfalls with dry-weather flow exist, sample locations should be prioritized according to the criteria mentioned above. In addition, field screening using only the field kits may occur during the field reconnaissance. However, it must be emphasized that the concurrent sampling and analyses of bacteria, surfactant, ammonia, and total chlorine parameters is the most efficient and cost-effective screening method.

When first observed, the physical attributes of each outfall or sampling location should be noted for construction materials, size, flow volume, odor, and all other characteristics listed on the data collection form (Attachment 4). In addition, GPS coordinates should be collected and a photograph of the sample location taken. Whenever possible, the sampling of storm drain outfalls should be conducted as close to the outfall opening as possible. Bacterial samples should be collected first, with care to not disturb sediment materials or collect surface debris/scum as best possible. A separate bottle is used to collect a single water sample from which aliquots will be analyzed for surfactants, ammonia, and total chlorine. A sample for PPCP analysis is recommended to be collected last, as the larger volume required and larger bottle size may cause some sediment disturbance in smaller outfalls or streams. If necessary, a second smaller, sterile and pre-cleaned sampling bottle may be used to collect the surface water which can then be poured into the larger PPCP bottle. Last, a properly calibrated temperature/specific conductance/salinity meter should be used to record all three parameters directly from the stream or outfall. When flow volume or depth is insufficient to immerse the meter probe, a clean sample bottle may be utilized to collect a sufficient volume of water to immerse the probe. In such instances, meter readings should be taken immediately.

As soon as reasonably possible, sample aliquots from the field kit bottle should be analyzed. When concurrent analyses are not possible, ammonia and chlorine samples should be processed first, followed by surfactant analysis, according to each respective Standard Operating Procedure as appropriate based on the particular brand and type of field test kit being used. All waste from the field test kits should be retained and disposed of according to manufacture instructions.

Where waste disposal issues would otherwise limit the use of field kits, EPA-NE recommends that, at a minimum, ammonia test strips with a Reporting Limit below 0.5 mg/L be utilized. Such test strips typically are inexpensive and have no liquid reagents associated with their use. Results should be recorded, samples placed in a cooler on ice, and staff should proceed to the next sample location.

Upon completion of sampling and return to the laboratory, all samples will be turned over to the appropriate sample custodian(s) and accompanied by an appropriate Chain-of-Custody ("COC") form.

Step IV – Data Evaluation

Bacterial results should be compared to the applicable water quality standards. Surfactant and ammonia concentrations should be compared to the thresholds listed in Table 1. Evaluation of the data should include a review for potential positive results due to sources other than human wastewater, and for false negative results due to chemical action or interferences. In the EPA-NE region, field sampling has indicated that the biological breakdown of organic material in historically filled tidal wetlands may cause elevated ammonia readings, as can the discharge from many landfills. In addition, salinity levels greater than 1 part per thousand may cause elevated surfactant readings, the presence of oil may likewise indicate elevated levels, and fine suspended particulate matter may cause inconclusive surfactant readings (for example, the indicator ampule may turn green instead of a shade of blue). Finally, elevated chlorine from leaking drinking water infrastructure or contained in the illicit wastewater discharge may inhibit bacterial growth and cause very low bacterial concentrations. Any detection of total chlorine above the instrument Reporting Limit should be noted.

Table 1 – Freshwater Water Quality Criteria, Threshold Levels, and Example Instrumentation [1]

Analyte/ Indicator	Threshold Levels/ Single Sample[3]	Instrumentation
E. coli [2]	235 cfu/100ml	Laboratory via approved method
Enterococci [2]	61 cfu/100ml	Laboratory via approved method
Surfactants (as MBAS)	≥ 0.25 mg/l	MBAS Test Kit (e.g. CHEMetrics K-9400)
Ammonia (NH_3)	≥ 0 .5 mg/l	Ammonia Test Strips (e.g. Hach brand)
Chlorine	> Reporting Limit	Field Meter (e.g. Hach Pocket Colorimeter II)
Temperature	See Respective State Regulations	Temperature/Conductivity/Salinity Meter (e.g. YSI Model 30)

[1] The mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. EPA

[2] 314 CMR 4.00 MA - Surface Water Quality Standards - Class B Waters.

[3] Levels that may be indicative of potential wastewater or washwater contamination

Once dry-weather data has been examined and compared to the appropriate threshold values, outfalls or more discreet reaches of surface water can be selected for sampling or further investigation. Wet-weather sampling is also recommended for all outfalls, in particular for those that did not have flow in dry weather or those with dry-weather flow that passed screening thresholds. Wet-weather sampling will identify a number of situations that would otherwise pass unnoticed in dry weather. These wet-weather situations include, but are not limited to the following: elevated groundwater that can now cause an exchange of wastewater between cracked or broken sanitary sewers, failed septic systems, underdrains, and storm drains; increased sewer volume that can exfiltrate through cracks in the sanitary piping; increased sewer volume that can enter the storm drain system in common manholes or directly-piped connections to storm drains; areas subject to capacity-related SSO discharges, and; illicit connections that are not carried through the storm drain system in dry-weather.

Step V – Costs

Use of field test kits and field instruments for a majority of the analytical parameters allows for a significantly reduced analytical cost. Estimated instrument costs and pro-rated costs per 100 samples are included in Table 2. The cost per 100 samples metric allows averaged costs to account for reagent refills that are typically less expensive as they do not include the instrument cost, and to average out the initial capital cost for an instrument such as a temperature/ conductivity/salinity meter. For such capital costs as the meters, the cost over time will continue to decrease.

Table 2 – Estimated Field Screening Analytical Costs [1]

Analyte/ Indicator	Instrument or Meter [2]	Instrument or Meter Cost/No. of Samples	Cost per Sample (Based on 100 Samples) [3]
Surfactants (as MBAS)	Chemetrics K-9400	$77.35/20 samples ($58.08/20 sample refill)	$3.09
Ammonia (NH_3)	Hach brand 0 – 6 mg/l	$18.59/25 samples	$0.74
Total Chlorine	Hach Pocket Colorimeter II	$389/100 samples ($21.89 per 100 sample refill)	$3.89
Temperature/ Conductivity/ Salinity	YSI	$490 (meter and cable probe)	$4.90

1 Estimated costs as of February 2011

2 The mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. EPA

3 One-time meter costs and/or refill kits will reduce sample costs over time

From Table 2, the field analytical cost is approximately $13 per outfall. Typical bacterial analyses costs can vary depending on the analyte, method, and total number of samples to be

performed by the laboratory. These bacterial analyses costs can range from $20 to $60. Therefore, the analytical cost for a single outfall, based on the cost per 100 samples, ranges from $33 to $73. As indicated above, these costs will decrease slightly over time due to one-time capitals costs for the chlorine and temperature/conductivity/salinity meters.

Step VI – Follow-Up

Once all laboratory data has been reviewed and determined final in accordance with appropriate quality assurance controls, results should be reviewed with appropriate stakeholders to determine next steps. Those outfalls or surface water segments that fail to meet the appropriate water quality standard, and meet or exceed the surfactant and ammonia threshold values, in the absence of potential interferences mentioned in Step IV, indicate a high likelihood for the presence of illicit connections upstream in the drainage system or surface water. Whereas illicit discharges are quite variable in nature, the exceedance of the applicable water quality standard and only the ammonia or surfactant threshold value may well indicate the presence of an illicit connection. When available, the concurrent collection and analyses of PPCP data can greatly assist in confirming the presence of human wastewater. However, such data will not be available in all instances, and the collective data set and information regarding the physical characteristics of each sub-catchment or surface water reach should be used to prioritize outfalls for further investigation. As warranted, data may be released to the appropriate stakeholders, and should be accompanied by an explanation of preliminary findings. Release of EPA data should be fully discussed with the case team or other appropriate EPA staff.

References Cited

Boston Water & Sewer Commission, 2004, *A systematic Methodology for the Identification and Remediation of Illegal Connections.* 2003 Stormwater Management Report, chap. 2.1.

Pitt, R. 2004 *Methods for Detection of Inappropriate Discharge to Storm Drain Systems. Internal Project Files*. Tuscaloosa, AL, *in* The Center for Watershed Protection and Pitt, R., *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*: Cooperative Agreement X82907801-0, U.S. Environmental Protection Agency, variously paged. Available at: http://www.cwp.org.

Instrumentation Cited (Manufacturer URLs)

MBAS Test Kit - CHEMetrics K-9400: http://www.chemetrics.com/Products/Deterg.htm

Portable Colorimeter – Hach Pocket Colorimeter II: http://www.hach.com/

Ammonia (Nitrogen) Test Strips: http://www.hach.com/

Portable Temperature/Conductivity/Salinity Meter: YSI Model 30: http://www.ysi.com/productsdetail.php?30-28

Disclaimer: The mention of trade names or commercial products in this protocol does not constitute endorsement or recommendation for use by the U.S. EPA.

EPA NE Bacterial Source Tracking Protocol – Attachment 1
Stormwater Outfalls With Indicators of Illicit Discharges

Note white, gray, or off-white filamentous bacterial growth

EPA NE Bacterial Source Tracking Protocol – Attachment 1
Stormwater Outfalls With Indicators of Illicit Discharges

Note off-white filamentous bacterial growth

Note gray bacterial growth, suds, cloudy and gray plunge pool

Stormwater Monitoring Quality Assurance Project Plan
2011-2016

RFA #

Sampling Plan Acceptance

EPA OES Enforcement and Project Manager/Coordinator **Signature:**	**Date:**
EPA OEME Project Managers/Coordinator **Signature:**	**Date:**
EPA OEME QA Officer **Signature:**	**Date:**
EPA Chemistry Team Lead **Signature:**	**Date:**

*** Draft Document for Informational Purposes Only ***

1.0 Background

U.S. EPA Administrative Order 5360.1 requires that "all projects involving environmental monitoring performed by or for the U.S. EPA shall not be undertaken without an adequate Quality Assurance Project Plan (QAPP)." The purpose of this document is to describe the process used to develop, select, manage, and finalize stormwater monitoring projects. In describing this process, quality assurance goals and methods will be established, thus ensuring that the overall program and each monitoring project will meet or exceed EPA requirements for quality assurance.

The objective of these projects will be to collect data that is usable by _____ for_____. The primary focus of this project will be on urban water stormwater outfalls in the New England Region watersheds.

2.0 Sampling overview

Monitoring will be conducted on pre-scheduled days with the Laboratory. Samples will be retrieved from surface water, in stream or outfalls at suspected hotspots or areas that need further delineation. Sample sites will be located using GPS, with an accuracy goal of ± 1 meter and PDOP less than 6. Less accurate GPS reading or coordinates from maps will be accepted when site or other conditions do not allow ± 1 meter accuracy.

The primary focus of this sampling will be used to identify illegal discharges. Results from the sampling will be used by_____. For this project, sampling will be conducted according to EPA's Ambient Water Sampling SOP (Table 3). Volunteers and watershed association staff may assist in sampling. All procedures will be followed that are specified in Table 3. Parameter to be sampled will be predetermined staff, based on data needs.

A. Locations

Site locations will be determined from field or desktop reconnaissance by project staff. Sample analyses will be predetermined based on conditions known about the sampling location prior to sampling. These may include data from previous sampling or from data collected from Mass DEP or local watershed associations. Any of the parameters listed in table 2 may be analyzed.

B. Analytical Methods and Reporting limits

Sample analyses will be conducted by EPA Laboratories.

Pharmaceuticals and Personal Care Products ("PPCPs"), E.coli and enterococcus will be analyzed by EPA's Laboratory. Surfactants, ammonia, total chlorine will be analyzed with field test kits. Potential additional laboratory analyses include nitrogen (nitrate/nitrite), TSS, BOD, surfactants, ammonia and TPH. The Laboratory used for each sampling event will be determined prior to sampling by the OEME Project Manager based on required analyses Laboratory availability and contract funds available.

Where available, a known concentration sample will be used to evaluate the performance of each test method. The known concentration sample will be processed in the field and Laboratory as a routine sample. The analyst or field technician will not know the concentration of the sample prior to analyzing and reporting the sample result. Sampling for PPCP testing will be done using

extreme care not to contaminate the sample. No caffeine products should be consumed prior to sampling.

Table 1: Parameter specifications

Parameter (lab - equipment)	Preservation	Holding time
PH	None	Immediate
Temperature	None	Immediate
Sp Cond	None	Immediate
DO	None	Immediate
Total Phosphorus (EPA)	H_2SO_4 (pH <2) + Ice	28 days
TSS (EPA)	Ice	7 days
TSS	Ice	7 days
BOD	Ice	48 hours
Surfactants	Ice	48 hours
Surfactants (field kit)	None	Immediate
Ammonia	H_2SO_4 (pH <2) + Ice	28 days
Ammonia (test strips)	None	Immediate
TPH Petroleum ID	Ice	7 Days to extraction 40 days after extraction
E. Coli (EPA)	Ice	6 hrs to lab
Enterococcus (EPA)	Ice	6 hrs to lab
PPCP	Ice (acidified in Lab)	7 day to extraction 40 days after extraction
Chlorine (Field kit)	None	Immediate

Table 2: Analytical References and Quality Control Goals

		Water Quality Criteria or Guidelines	Quality Assurance Goals		
Parameter (lab- equipment)	**Reporting Limits**	**(MA or EPA)**	**Precision**	**Accuracy**	**Completeness**
PH	4 to 10 units	6.5 - 8.3	0.02 unit	± 0.3 units	90%
Temperature	0 to +40°C	28.3°C	0.1 °C	± 0.15°C	90%
Sp Cond	0 to 100 mS/cm	NA	5 uS/cm	±10% cal std (µS/cm)	90%
DO	0.5mg/l to Sat	≥5 mg/l , ≥60% saturation	0.02mg/l	± .5 mg/l	90%
Total Phosphorus (EPA)	5.0 ug/l	NA	Field dup 30% RPD	MS 70-130%	90%
TSS (EPA)	5mg/L	NA	Field dup 30% RPD	See SOP	
TSS	5 mg/L	NA	Field dup 30% RPD	See SOP	90%
BOD	2 mg/L	NA	Field dup 30% RPD	See SOP	90%
Surfactants (field kit)	0.25 mg/L[1]	0.25 mg/L	Field dup 30% RPD	TBD	90%
Ammonia (test strips)	0.25 mg/L[1]	1.0 mg/L	Field dup 30% RPD	TBD	90%
TPH Petroleum ID	Variable	NA	Field dup 30% RPD	See SOP	
E. Coli (EPA)	4 col./ 100 ml	<=126 col./100 ml* <= 235 col./100 ml	±100 col/100ml or 30% RPD	N/A	90%
Enterococcus (EPA)	1 col/100ml	<=33 col./100 ml* <= 61 col./100 ml	±100 col/100ml or 30% RPD	See SOP	90%
PPCP	TBD	NA	Field dup 50% RPD	TBD	90%
Chlorine (Field kit)	0.02 mg/l	NA	Field dup 30% RPD	TBD	90%

Note
*Geometric mean Criteria
TBD = To be determined, Field methods and some colorimeter methods do not have accuracy criteria determined.
[1] Needs field verification to confirm

Table 3: Field and Laboratory References

Parameter	Analytical Method Reference	SOP reference
	Field References- 5/2005	
pH		
Conductivity		
Temperature		
dissolved oxygen	n/a	ECASOP-YSISondes9
Ambient water samples	n/a	ECASop-Ambient Water Sampling2
Chain of custody of samples	n/a	EIASOP-CHAINOFCUST
Sample login, tracking, disposition	n/a	EIASOP-ADMLOG14
	Lab. References- 5/ 2005	
Total Phosphorus (EPA)	EPA 365.3	EIASOP-INGTP8
TSS (EPA)	EPA 160.2	EIASOP-INGTSS-TDS-VRES5
TSS	EPA 160.2,SM2540D	SOP
BOD	EPA 405.1,SM5210B	SOP
Surfactants (field kit)		Draft
Ammonia (test strips)		Draft
TPH Petroleum ID	8015B (M)	
E. Coli (EPA)	SM9230	ECASOP- TC/EC Colilert2
Enterococcus (EPA)	SM9230	ECASOP-Enterolert1
PPCP	EPA 1694	TBD
Chlorine (Field kit)		TBD

*Specific conductance is the only parameter identified as non critical

Bottle list

Table 4: Bottle Sampling List

Parameter (lab - equipment)	Bottle	Preservation
Primary analyses		
E. Coli (EPA)	(2) 120ml or 250ml sterile	Ice
Enterococcus (EPA)		Ice
PPCP	1 Liter Amber	Ice (acidified in Lab)
Optional analyses		
Chlorine	500 ml	Ice
Total Phosphorus (EPA)	125 ml	H_2SO_4 (pH <2) + Ice
TSS (EPA)	1 liter	Ice
TSS	1 liter	Ice
BOD	1 Liter	Ice
TPH Petroleum ID	2 -1 Liter Amber Glass teflon lined	Ice
E. Coli (alt lab)	120 ml sterile	Ice
Enterococcus (alt lab)	120 ml sterile	Ice

C. Quality Control

Calibration:	EPA will calibrate its sondes according to the EPA sonde calibration SOP.
Field duplicate:	One duplicate sample will be collected per sampling event or approximately for every ten samples.
Trip Blank:	OEME Chemist will run appropriate QA samples for PPCP's. One blank sample will be collected for approximately every ten bacteria samples. Reported data that is less than 5 times the trip (field) blank concentration will be flagged.
QC Criteria:	Are specified in table 2, data not meeting this criteria will be reviewed by the Project Manager. Data that does not meet laboratory QA/QC criteria will be flagged by the laboratory.

D. Chain of Custody

Chain of custody procedures will follow the OEME/Investigations Office SOP (Table 3)

3.0 Data Review

EPA Microbiology data will be reviewed by the Biology QAO. Microbiology sample results for samples analyzed by an outside laboratory will be reviewed by the OEME Project Manager. All field data and draft data reports will be reviewed by the OEME Project manager. All laboratory generated data will be reviewed by the Chemistry Team Leader.

4.0 Data reports

Data reports will be reviewed by the Project Coordinator and the OEME Project Manager before a final report is released to the Project Manager. Draft reports may be released without a complete review.

5.0 Attachments (Q:\share\RARE\QAPP)

1) Standard Operating Procedure Enterococcus (SM9230B), Multiple Tube Technique. SOP/07-01 *Alpha Analytical, Inc. May 28, 2005*

2) Standard Operating Procedure E. Coli (SM9213D). SOP/07-41 *Alpha Analytical, Inc. May 28, 2005*

3) Standard Operating Procedure MBAS, Ionic Surfactants. Draft SOP *EPA Laboratory. January 28, 2010*

4) Standard Operating Procedure Nitrogen Ammonia. Draft SOP *EPA Laboratory. February 10, 2011*

5) Standard Operating Procedure Total Chlorine. Draft SOP *EPA Laboratory. February 12, 2010*

6) Standard Operating Procedure TSS/ TVSS (SM2540 D, EPA 160.2). SOP/07-29 *Alpha Analytical, Inc. September 29, 2007*

7) Standard Operating Procedure BOD-5day, SBOD-5day, and cBOD-5day (SM 5210B, and EPA 405.1). SOP/07-13 *Alpha Analytical, Inc. September 29, 2007*

8) Standard Operating Procedure TPH 8015D – Modified 0-017 (EPA 8015D Modified) *Alpha Analytical, Inc. March 04, 2008*

9) Standard Operating Procedure determination of Trace Elements in Water and Wastes by Inductively Coupled Plasma- Mass Spectrometry (200.8). SOP/06-11 Alpha Analytical, Inc. July 13, 200

10) Standard Operating Procedure Inductively Coupled Plasma – Mass Spectrometry (6020). SOP/06-10 Alpha Analytical, Inc. October 25, 2007

EPA NE Bacterial Source Tracking Protocol – Attachment 3
Target Compounds, Uses, and Reporting Limits

Target Compound	Major Use	RL (ng/L)	Daily Dose (ng)
Caffeine	Natural Stimulant	5.0	200,000,000
1,7-DMX	Metabolite of caffeine	2.5	N/A
Acetaminophen	Pain Reliever	2.5	650,000,000
Carbamazepine	Anti- depressant / bi-polar Anti-convulsant (epilepsy)	0.5	100,000,000
Primidone	Anti- epilepsy drug (AED)	5.0	100,000,000
Atenolol	Beta Blocker High Blood Pressure	2.5	50,000,000
Cotinine	Metabolite of Nicotine	0.5	3,500-7,200 (ng/mL)
Urobilin	By-product of hemoglobin breakdown (mammals)	5.0	1,300,000 ng/g in feces
Azithromycin	Antibiotic	1.6	200,000,000

STORMWATER MONITORING

Field Collection Requirements (To be recorded at each site)

Sample
Site Name _____

Time collected_____

Date collected_____

Inspection
****Take picture at site****
Outfall diameter_____('na' if open stream)

Flow estimate_____('na' if open stream)

Odor_____

Color_____

Turbidity_____

Floatables_____

Other observations_____

_____

YSI Meter (calibrate in lab)
Salinity_____

Temp_____

Conductivity (give both #'s)

_____

Location information
Short description of where sample was collected at site_____

_____

_____

GPS_____

_____

Field Kits listed in the order they should be conducted in, include any applicable notes-

NH3 strip_____

Cl2 kit_____

Surfactants_____

Additional Notes:

(Note any changes in weather conditions)_____

_____

_____

_____

_____

APPENDIX D

"EPA MS4 Outfall and Water Quality Data Collected in Quincy, MA"
2009-2020

0 1,000 2,000 Feet

N W E S

- Quincy Samples
- Wollaston Beach Samples

Quincy, MA
EPA Sample Locations
MS4 Outfall and Water Quality Data 2009 to 2020

US EPA Region 1 GIS Center
4/5/2021. Map Tracker ID: 13278
Sources: Basemap:Bing, Locations: EPA

EPA

0 500 1,000 Feet

N W E S

● Wollaston Beach Samples

Wollaston Beach Quincy, MA
EPA Sample Locations
MS4 Outfall and Water Quality Data 2009 to 2020

US EPA Region 1 GIS Center
4/5/2021 Map Tracker ID:13278
Sources: Basemap:Bing, Locations: EPA

EPA

US EPA MS4 Outfall and Water Quality Data Collected in Quincy, MA 2009 through 2020

Location				Sampling					PPCP ng/L																	Paragraph 29.a Outfall
Date	Town	Site Name	Time	E.coli (MPN/100 ml)	Entero (MPN/100ml)	Surfactant Field	Cl2 Field	NH3 Test St.	Atenolol	Acetaminophen	Cotinine	1,7-Dimethyl xanthine	Caffeine	Azithro-mycin	Primidone	Metoprolol	Urobilin	hydramine	Carba-mazepine	GPS North (+)	GPS West (-)	Salinity ppt	Temp C	Conductivity mS	Wet/Dry?	
6/9/09	Quincy	WollB1	7:35	420	1741	1.5	ND	ND (0.1)	1.9	55	0.63	47	71	ND (0.2)	ND (2.0)	NA	78	NA	0.58	42.278672	-71.012859	4.7	15.2	10.6	Dry	Yes
6/9/09	Quincy	WollB5	8:25	ND	ND	0.2	0.07	0.6	ND (1.0)	5.8	0.29	12	34	ND (0.2)	ND (2.0)	NA	2.5	NA	1.5	42.287572	-71.022259	1	15	1.913	Dry	
7/14/09	Quincy	WollB2	9:50	265	8	2	ND	ND (0.1)	ND (1.0)	2.9	ND (0.2)	4.9	11	ND (0.2)	ND (2.0)	NA	9.2	NA	0.56	42.266485	-70.997104	28.5	20.5	40.4	Dry	
7/14/09	Quincy	WollB1A	11:08	3080	1844	0.75	0.53	ND (0.1)	3.1	26	0.43	22	58	ND (0.2)	ND (2.0)	NA	290	NA	4	42.277357	-71.008933	2.7	17.1	12	Dry	Yes
7/14/09	Quincy	UR001	11:27	1741	5654	na	na	na	7	17	1.1	60	59	ND (0.2)	ND (2.0)	NA	1900	NA	0.46	42.278672	-71.012859	na	na	na	Dry	Duplicate of WollB1
7/14/09	Quincy	WollB1	11:27	2190	6932	0.25	0.10	ND (0.1)	6.3	15	0.93	55	58	ND (0.2)	ND (2.0)	NA	2500	NA	0.48	42.278672	-71.012859	3	16.1	5.55	Dry	Yes
8/11/09	Quincy	Canal1	7:55	1844	417	0.15	0.14	ND (0.1)	ND (2.0)	15	0.46	7.1	56	ND (0.4)	ND (4.0)	NA	100	NA	4.7	42.250692	-70.997793	0.5	19.7	1.08	Dry	**
8/11/09	Quincy	SAG1	8:25	3922	1230	2	0.11	0.75	~3.3	81	ND (0.4)	14	100	0.55	ND (4.0)	NA	700	NA	2.9	42.276164	-71.037225	13	18.5	23.3	Dry	**
8/11/09	Quincy	SAG2	8:50	ND	ND	0.7	0.21	6	na	na	na	na	na	na	na	NA	na	NA	na	42.276174	-71.037325	na	na	na	Dry	
8/11/09	Quincy	WollB1B	9:40	133	12	2.2	0.38	ND (0.1)	ND (2.0)	ND (2.0)	ND (0.4)	ND (2.0)	ND (4.0)	ND (0.4)	ND (4.0)	NA	7	NA	0.56	42.277357	-71.008933	25	18.8	39.1	Dry	
8/11/09	Quincy	WollB1A	9:45	437	161	1.5	0.15	ND (0.1)	ND (2.0)	3.8	ND (0.4)	ND (2.0)	20	ND (0.4)	ND (4.0)	NA	23	NA	3.2	42.277357	-71.008933	12	19.4	30.7	Dry	Yes
8/11/09	Quincy	UR009	10:25	489	363	0.6	0.02	0.10	ND (2.0)	40	~0.78	6.6	28	1.6	ND (4.0)	NA	260	NA	0.54	42.278672	-71.012859	na	na	na	Dry	Duplicate of WollB1
8/11/09	Quincy	WollB1	10:25	626	518	0.7	0.02	0.10	ND (2.0)	41	~0.82	7	31	1.6	ND (4.0)	NA	250	NA	0.6	42.278672	-71.012859	1.9	19	4.172	Dry	Yes
5/19/10	Quincy	FBP02	8:15	4813	3873	0.25	ND	0.1	3.7	30	17	7.7	190	1.3	ND (5.0)	NA	560	NA	0.67	42.25766282	-71.00896849	0.2	12.2	0.3606	Wet	**
5/19/10	Quincy	UR024	8:15	3922	3654	0.3	0.03	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	42.25766282	-71.00896849	na	na	na	Wet	Duplicate of FBP02
5/19/10	Quincy	FBP03	8:55	5654	5172	0.4	ND	ND	5	64	18	11	160	ND (0.4)	ND (5.0)	NA	600	NA	0.68	42.25627321	-71.02067588	0.2	12.3	0.4285	Wet	**
5/19/10	Quincy	Broad1	9:25	3466	2755	2	0.03	ND	ND (2.0)	53	17	7.5	180	ND (0.4)	ND (4.0)	NA	1300	NA	0.84	42.25620978	-70.99314315	8.1	13.3	14.1	Wet	Yes
5/19/10	Quincy	Sag1A	10:15	13340	2098	1.7	0.15	ND	7.1	210	19	41	380	1.7	ND (4.0)	NA	2700	NA	3.6	42.27602123	-71.0320993	4.3	12.6	7.78	Wet	Yes
5/19/10	Quincy	WollB1A	10:40	4480	3282	0.5	ND	0.1	21	56	16	54	190	9.3	ND (4.0)	NA	3900	NA	1.4	42.277357	-71.008933	0.3	12.4	675	Wet	Yes
5/19/10	Quincy	WollB1	11:00	2747	6131	0.75	0.07	ND	6.2	130	13	60	720	ND (0.4)	ND (4.0)	NA	15000	NA	ND (0.4)	42.278672	-71.012859	3.5	12.8	4.87	Wet	Yes
5/19/10	Quincy	Sag1B	11:45	20980	3654	0.5	0.05	1	64	350	22	140	530	17	ND (4.0)	NA	6100	NA	3	42.27361693	-71.03395231	1.1	13.1	1.708	Wet	Yes
10/27/10	Quincy	WollB1	8:05	147	197	1.25	0.04	0	ND (10.0)	120	8.1	46	130	ND (2.0)	ND (20.0)	NA	ND (20.0)	NA	ND (2.0)	42.278672	-71.012859	17.3	13.8	28.18	Dry	Yes
10/27/10	Quincy	WollB1A	8:10	192	121	2	0.02	0	ND (10.0)	6.7	2.4	12	22	ND (2.0)	ND (20.0)	NA	20	NA	ND (2.0)	42.277357	-71.008933	13.2	14.3	24.89	Dry	Yes
10/27/10	Quincy	WollB1B	8:18	58	20	2.5	0	0.25	ND (10.0)	ND (10.0)	2.6	10	ND (20.0)	ND (2.0)	ND (20.0)	NA	ND (20.0)	NA	ND (2.0)	42.277357	-71.008933	24.4	14.7	38.45	Dry	
10/27/10	Quincy	Sag1A	10:15	5630	2909	0.75	0.03	6	ND (10.0)	330	260	130	4100	84	34	NA	910	NA	ND (2.0)	42.275935	-71.031798	3.4	15.8	6.23	Wet	Yes
10/27/10	Quincy	SagA2	10:20	ND	ND	0	0.03	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	42.275941	-71.031767	0	13.9	91.6	Wet	
10/27/10	Quincy	Sag1B	10:30	4480	2851	0.5	0.02	1	ND (10.0)	320	99	110	2000	ND (2.0)	ND (20.0)	NA	410	NA	3.8	42.273601	-71.034010	0.8	15.4	1.59	Wet	Yes
10/27/10	Quincy	Sag1C	10:58	2452	2723	0.6	0.06	0.5	ND (10.0)	81	280	100	3200	38	ND (20.0)	NA	64	NA	ND (2.0)	42.273990	-71.030634	1.5	16.9	33.2	Wet	Yes
10/27/10	Quincy	Bay1	11:40	173290	365400	NA	NA	>6	2200	29000	360	12000	69000	200	ND (1000.0	NA	20000	NA	ND (100.0	42.299943	-71.006177	8.4	17.9	0.834	Wet	
10/27/10	Quincy	BayBch	11:45	25	ND	3	0	0	ND (2.0)	ND (2.0)	1.9	1.6	16	ND (0.4)	ND (4.0)	NA	2.9	NA	0.5	42.299779	-71.005800	37.1	13.7	43.74	Wet	
10/27/10	Quincy	WollBch2	12:30	21	ND	2	0.01	0	ND (2.0)	ND (2.0)	2.2	4.7	11	ND (0.4)	ND (4.0)	NA	4.4	NA	0.46	42.277051	-71.009467	31.3	13.2	41.01	Wet	
10/27/10	Quincy	WollBch1	12:35	113	ND	3	0.04	0	ND (2.0)	2.2	2.4	7.5	52	ND (0.4)	16	NA	ND (4.0)	NA	ND (0.4)	42.278670	-71.013452	31.3	13.6	47.97	Wet	
8/8/12	Quincy	Canal2	7:40	170	118	NA	NA	NA	0.82	2.9	6.3	8.2	35	NA	NA	0.92	NA	NA	8.3	42.247565	-70.999775	0.6	19.4	1.28	Dry	
8/8/12	Quincy	Broad1	7:50	1102	30	NA	NA	NA	ND (2.0)	2.7	7.2	5.4	46	NA	NA	ND (2.0)	NA	NA	2.3	42.256124	70.993904	19.2	21.4	30.94	Dry	Yes
8/8/12	Quincy	Sag1C	8:45	1642	259	NA	NA	NA	9.1	23	14	15	280	NA	NA	1.9	NA	NA	2.8	42.273941	71.030523	14	21.7	22.96	Dry	Yes
8/8/12	Quincy	Sag1B	8:55	1954	1467	NA	NA	NA	51	200	55	55	110	NA	NA	4.1	NA	NA	2.9	42.273617	71.033979	10.6	19.4	17.93	Dry	Yes
8/8/12	Quincy	Sag1A	9:10	1462	110	NA	NA	NA	5	43	12	37	150	NA	NA	2.4	NA	NA	2.8	42.275967	71.031824	9.7	19.7	16.56	Dry	Yes
8/8/12	Quincy	47 New	9:32	416	63	NA	NA	NA	ND (2.0)	8.8	2.8	5	18	NA	NA	ND (2.0)	NA	NA	2.7	42.280101	71.036427	16.1	20.7	25.84	Dry	Yes
8/8/12	Quincy	25 New	9:40	224	52	NA	0.00	0.75	ND (2.0)	10	15	5.8	95	NA	NA	ND (2.0)	NA	NA	0.9	42.280122	71.036472	4.2	21.2	7.6	Dry	Yes
8/8/12	Quincy	WollB4	10:15	97	98	NA	NA	NA	0.91	2.1	3.1	1.6	13	NA	NA	1.6	NA	NA	0.8	42.281345	71.017206	11.1	22.4	18.97	Dry	
8/8/12	Quincy	Milton	10:16	108	10	NA	NA	NA	0.81	0.81	2.5	1.8	9.7	NA	NA	0.2	NA	NA	0.47	42.282533	71.015902	30.2	23.9	46.93	Dry	
8/8/12	Quincy	WollB3	10:25	842	2187	NA	NA	NA	12	11	1.9	13	12	NA	NA	0.83	NA	NA	0.8	42.28010051	71.01540931	18.4	20.9	29.66	Dry	Yes
8/8/12	Quincy	Woll B1A	10:50	1954	155	0	0.07	0	1.1	15	4.5	5.5	42	NA	NA	1.6	NA	NA	1	42.27730039	71.00762431	26	22	38.86	Dry	Yes
8/8/12	Quincy	Woll B1B	10:52	782	31	NA	0.01	0	ND (2.0)	ND (2.0)	1.2	1.3	25	NA	NA	ND (2.0)	NA	NA	0.7	42.27737686	71.00891502	23.5	21	37.19	Dry	
8/8/12	Quincy	Sachem	10:54	58	ND	NA	NA	NA	ND (2.0)	1.7	2.9	2.6	11	NA	NA	ND (2.0)	NA	NA	0.45	42.27763881	71.00813683	30.8	23.8	47.35	Dry	
8/8/12	Quincy	WollB1	11:20	666	1354	NA	0	0	7.4	17	11	56	73	NA	NA	ND (2.0)	NA	NA	0.57	42.27868686	71.01287707	30.1	24	46.34	Dry	Yes
8/8/12	Quincy	Woll D	11:20	489	1396	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	42.278687	71.012877	NA	NA	NA	Dry	Duplicate of WollB1
8/8/12	Quincy	Channing	11:22	205	20	NA	NA	NA	1.3	0.93	2.8	2.3	12	NA	NA	ND (2.0)	NA	NA	0.49	42.279415	71.013176	31.2	23.8	47.89	Dry	
8/8/12	Quincy	164 Crab	12:05	149	ND	NA	NA	NA	0.84	1.3	3.2	2.8	12	NA	NA	ND (2.0)	NA	NA	0.46	42.29033915	71.01735306	31.6	25.4	48.43	Dry	
8/8/12	Quincy	Bay 2	12:40	365400	46110	NA	1.1	>6	330	290	1100	310	590	NA	NA	110	NA	NA	ND (2.0)	42.299931	71.006178	NA	NA	NA	Dry	
5/14/13	Quincy	Channing	8:25	115	52	NA	NA	NA	2.4	2.7	2.3	4.6	16	NA	NA	2.3	NA	NA	0.43	42.279415	71.013176	30.5	13.3	46.94	Dry	
5/14/13	Quincy	Woll B1	8:31	7945	1607	NA	0.1	0	3.7	44	3.3	43	71	NA	NA	1.2	NA	NA	0.31	42.278687	71.012877	8.9	12.2	15.26	Dry	Yes
5/14/13	Quincy	Woll B5	8:55	4	ND	NA	0.03	0.6	ND	5.5	9.3	10	180	NA	NA	ND (2.0)	NA	NA	0.25	42.287421	71.022346	0.9	13.8	1.77	Dry	
5/14/13	Quincy	Saratoga	9:25	4	ND	NA	0.02	1	ND	ND	2.5	2.4	12	NA	NA	ND (2.0)	NA	NA	0.33	42.288038	71.022730	1.6	13.8	3.1	Dry	
5/14/13	Quincy	Milton	9:50	53	10	NA	NA	NA	ND	2	1.9	2.5	12	NA	NA	ND (2.0)	NA	NA	0.34	42.282533	71.015902	31.6	15.9	40.11	Dry	
5/14/13	Quincy	Sag 1A	10:10	4185	1935	NA	0	1	3.3	200	13	140	220	NA	NA	2.6	NA	NA	2.2	42.275967	71.031824	5.1	12.4	9.6	Dry	Yes
5/14/13	Quincy	Sag 1C	10:30	396	226	NA	0.04	0.25	5.1	24	8.8	30	110	NA	NA	2.5	NA	NA	1.5	42.273941	71.030523	8.3	12.2	1.32	Dry	Yes
5/14/13	Quincy	Sag 1B	10:45	4480	1198	0.2	0.03	1	24	41	6.3	49	150	NA	NA	7	NA	NA	2.3	42.273617	71.033979	0.6	11.4	1.11	Dry	Yes
5/14/13	Quincy	FBP 02	11:20	229	109	NA	NA	NA	4.4	7.2	1.1	4.4	11	NA	NA	ND (2.0)	NA	NA	0.6	42.258027	71.008746	0.3	12.1	0.7	Dry	**
5/14/13	Quincy	FBP 03	11:45	109	63	0.15	0	0.25	6.2	8.9	1.7	16	28	NA	NA	1.7	NA	NA	0.71	42.256382	71.020544	0.3	12.1	0.68	Dry	**
5/14/13	Quincy	FBP 03N	11:50	109	85	0.2	0	0	4.8	5	1.7	19	16	NA	NA	ND (2.0)	NA	NA	0.64	42.256382	71.020544	0.3	12.1	0.7	Dry	**
6/10/20	Quincy	WollB1B	8:58	21	31	NA	0.03	0.25	ND	4.2	1.5	ND	4.1	NA	NA	ND	NA	ND	ND	42.277294	71.007615	26.4	15.8	41.11	Dry	
6/10/20	Quincy	WollB1A	9:10	740	1334	NA	0.03	0.25	ND	10	2.2	5.3	24	NA	NA	ND	NA	ND	0.43	42.277373	71.008926	13.3	15.5	22.02	Dry	Yes
6/10/20	Quincy	WollB1	9:50	621	6131	NA	0.02	0.25	ND	12	1.9	12	20	NA	NA	ND	NA	0.62	0.5	42.278674	71.012889	13.8	15.7	22.74	Dry	Yes
6/10/20	Quincy	WollB3	10:18	236	265	NA	0.04	0	ND	ND	0.53	ND	ND	NA	NA	ND	NA	ND	ND	42.280236	71.015264	21.6	16.8	34.26	Dry	
6/10/20	Quincy	WollB4	10:51	363	767	NA	0.01	0.25	ND	4.6	3	9.9	19	NA	NA	ND	NA	ND	0.47	42.281338	71.017198	21.6	18.7	34.4	Dry	
6/10/20	Quincy	Sag1A	11:30	354	369	NA	0.05	0.25	ND	19	5.1	14	40	NA	NA	2.2	NA	0.52	1.3	42.275987	71.031864	7.2	15.1	12.79	Dry	Yes
6/10/20	Quincy	Sag1B	12:15	818	1789	0.35	0.05	0.25	15	104	2.9	60	110	NA	NA	21	NA	0.81	5.5	42.273593	71.033991	0.8	14.2	1.57	Dry	Yes

6/10/20	Quincy	Sag1C	12:55	30	20	0.75	0.03	0.25	ND	ND	2.4	ND	14	NA	NA	ND	NA	ND	1	42.274024	71.030626	3.4	16.1	5.84	Dry	Yes
7/8/20	Quincy	CoveWay	8:15	690	203	NA	0.02	0.25	ND	ND	1.47	2.27	4.5	NA	NA	ND	NA	ND	ND	42.252125	70.982664	26.5	20.8	41.3	Dry	
7/8/20	Quincy	Broad1	8:42	1041	135	NA	0.02	0.5	ND	12.2	7.94	3.29	16.8	NA	NA	ND	NA	ND	2.64	42.25913	70.99602	12	18.6	20.1	Dry	Yes
7/8/20	Quincy	364SeaA	9:17	6212	20	NA	0	0	ND	64.9	8.99	18.3	41.5	NA	NA	ND	NA	ND	0.407	42.264093	70.986124	26.8	20	41.68	Dry	Yes
7/8/20	Quincy	WollB1B	10:07	273	767	NA	0.06	0	ND	ND	0.857	ND	6.09	NA	NA	ND	NA	ND	ND	42.277294	71.007615	25.2	19.1	39.47	Dry	
7/8/20	Quincy	WollB1A	10:17	482	41	NA	0.05	0	ND	4.04	2.65	2.27	9.45	NA	NA	ND	NA	ND	ND	42.277373	71.008926	NA	NA	NA	Dry	Yes
7/8/20	Quincy	WollB1	10:30	953	624	NA	0.06	0.25	ND	113	4	36.7	39.3	NA	NA	ND	NA	0.455	0.476	42.278674	71.012889	28.3	22.8	43.04	Dry	Yes
7/8/20	Quincy	Saratoga	11:18	9678	24196	NA	0.03	3	210	7400	200	3200	5100	NA	NA	38	NA	55	1.7	42.287286	71.026345	3.3	19.4	6.03	Dry	Yes
7/8/20	Quincy	25New	11:48	241	161	NA	0.05	0.25	ND	7.87	15.8	3.31	101	NA	NA	ND	NA	ND	0.827	42.2801223	71.0364717	13	20.3	21.84	Dry	Yes
7/8/20	Quincy	47New	11:55	3466	862	NA	0.02	0	3.47	71.3	5.18	37.4	231	NA	NA	2.44	NA	2.51	2.78	42.28010103	71.03642717	14.7	21.2	24.48	Dry	Yes
7/8/20	Quincy	Sag1A	12:25	4480	583	NA	0.05	0.25	2.59	35.4	4.97	25.8	66.6	NA	NA	3.98	NA	0.485	2.56	42.275987	71.031864	6.8	21.6	11.91	Dry	Yes
7/8/20	Quincy	Sag1B	12:50	1016	201	NA	0.06	0	ND	6.41	3.18	5.2	28.8	NA	NA	ND	NA	ND	2.4	42.273593	71.033991	17	23	27.67	Dry	Yes

COLOR CODES

E. coli - color key: Red ≥ 10,000 col/100ml, Orange ≥ 1260 col/100ml, Yellow ≥ 235 col/100ml, Black < 235 col/100ml

Entero - color key: Red ≥ 1000 col/100ml, Orange ≥ 350, Yellow ≥ 104 col/100ml, Black < 104 col/100ml

NH3 - color key: Red ≥ 6 mg/L, Orange ≥ 3 mg/L, Yellow ≥ 0.5 mg/L, Black < 0.5 mg/L

Surfactants - color key: Red ≥ 1.0 mg/L, Orange ≥ 0.5 mg/L, Yellow ≥ 0.25 mg/L, Black < 0.25 mg/L *** may give false positive at salinity greater than 1 ppt

Cl2 - color key: Red ≥ 1.0 mg/L, Orange ≥ 0.3 mg/L, Yellow ≥ 0.02 mg/L, Black < 0.02 mg/L

PPCP - color key: Dark Pink ≥ 100x the RL; Pink ≥ 10x the RL; Light Pink ≥ 3x the RL

Salinity - color key: Light Blue ≥ 1 ppt (see Surfactants)

Site Name in light orange are MS4 Outfalls as opposed to receiving water samples

** Denotes sample collected from a receiving water (but not from a MS4 Outfall) that indicates an upstream source of sanitary sewage

REPORTING LIMITS

E. coli = 4 MPN/100mL

Enterococcus = 10 MPN/100mL

Surfactants Field = 0.1 mg/L

Ammonia Test Strip = 0.1 mg/L

PPCP = as noted in parentheses

MISCELANEOUS

ND – not detected above the associated detection limit

NA – not applicable (analyte not tested for at the particular MS4 outfall at this time)

RL - Reporting Limit

(~) – data reported as estimate